California Regional Water Quality Control Board
Santa Ana Region

Terry Tamminen
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Arnold Schwarzenegger
Governor

January 15, 2004

Mr. Peter H. Wulfman, Division Manager
Solid Waste Management Division
County of San Bernardino Department of Public Works
222 West Hospitality Lane, Second Floor
San Bernardino, CA 92415-0017

CLEANUP AND ABATEMENT ORDER NO. R8-2003-0013 - COMMENTS ON EVALUATION REPORT ON PERCHLORATE IMPACTS TO SOILS AND GROUNDWATER FROM PROPERTY OWNED BY SAN BERNARDINO COUNTY AT THE FORMER BUNKER AREA NEAR THE MID-VALLEY SANITARY LANDFILL (MVSL)

Dear Mr. Wulfman:

We have reviewed the October 2003 report, submitted on October 15, 2003, titled "Evaluation of Perchlorate Impacts To Soils and Groundwater Near Former Bunker Area, Rialto, California". This evaluation report was prepared by your consultant, GeoLogic Associates (GLA), and was submitted in response to Cleanup and Abatement Order No. R8-2003-0013, adopted by the Regional Board on January 17, 2003. This evaluation report presents the results of field investigations that were performed in several phases from August 2002 to September 2003. Several status summary reports for the field investigations were routinely provided to us for review. The investigations included 17 shallow exploratory boreholes or excavations to obtain soil samples from areas where bunker debris was believed to be deposited, sampling from 5 deep exploratory boreholes advanced in the 5 aggregate wash ponds in the former bunker area, and drilling and construction of 57 temporary and 13 permanent groundwater monitoring wells (N-1 through N-10, F-6A, S-1R and S-2) downgradient of the MVSL and the former bunker area. Slug and bail aquifer tests were performed in three of the monitoring wells (N-6, N-7 and N-8). In addition to the fieldwork, a three-dimensional numerical groundwater model of the project area was developed to simulate groundwater flow and contaminant transport conditions near the site and to evaluate alternative responses to groundwater impacts in the area.

Members of the Inland Empire Perchlorate Regulatory Task Force provided written comments on the evaluation report to us, and those comments were considered in preparing this response. All written comments received from the Task Force members are provided as enclosures with this letter. Their comments are being provided to allow the County the opportunity to respond to those comments.

Background

Perchlorate near the MVSL was first detected in 1997 in low concentrations (less than 5 µg/l) in groundwater samples collected from two of the MVSL monitoring wells (F-3 and F-6) located near the central east boundary of the County's property. In 2001, the concentration of

perchlorate in F-6, the easternmost of the two affected monitoring wells, suddenly increased to 250 µg/l. Monitoring well F-6 is located immediately downgradient of a portion of the MVSL Unit 5 expansion area.

In order to better determine the probable source and to characterize the extent of perchlorate downgradient of the proposed MVSL Unit 5 expansion area, the County installed six permanent monitoring wells (F6A, N-1, N-2, N-3, N-4 and N-5) in 2002. In addition, two monitoring wells (S-1R and S-2) were installed approximately 1,300 and 2,600 feet south of the MVSL, respectively, to determine if the MVSL might be a current source of perchlorate. Each well was drilled to the B-C aquitard or into the regional groundwater production zone (C-Zone). Perchlorate was not detected in monitoring wells S-1R and S-2. Therefore, information was not obtained that indicated the MVSL is a current source of perchlorate in groundwater.

Perchlorate was detected in groundwater samples obtained from monitoring wells installed south and southeast (downgradient) of the proposed MVSL Unit 5 expansion area (F-6A, N-1, N-3 and N-5), with the highest concentration of 1,000 µg/l found in monitoring well N-3. Perchlorate was not detected in any of the groundwater samples collected from wells installed north and northeast (upgradient) of the proposed MVSL Unit 5 expansion area (N-2 and N-4).

The analytical results of groundwater samples collected from these eight wells indicated that a source of perchlorate existed in the vicinity of the proposed MVSL Unit 5 expansion area, and that groundwater impacts extended further south and east of these wells. As a result, further investigation of groundwater downgradient of these monitoring wells was required. In November 2002, the County submitted a work plan to identify the contaminant source and to characterize the vertical and horizontal extent of the perchlorate and volatile organic compound (VOC) plumes emanating from the proposed Unit 5 expansion area. In January 2003, I conditionally approved the proposed work plan and fieldwork was initiated soon after.

The northeastern area of the County's property, which consists of approximately 120 acres and has been designated as the future Unit 5 expansion area, was purchased in 1994. This property contained 19 storage bunkers. The federal government constructed these bunkers during World War II for the storage of munitions. Following World War II, the property was subdivided and sold. Subsequent to World War II, the bunkers appeared to have been used by various parties, in part, for storage of explosives and fireworks. A portion of the property the County purchased in 1994 was also apparently used for the manufacture of fireworks and the open burning or detonation of explosives by a hazardous waste facility. The County's operations contractor demolished the bunkers in 1998, and some of the debris from the bunkers was reportedly placed in certain areas on the County's property. A sand and gravel operation (Robertson's Ready Mix) now utilizes a portion of the subject property, and another portion of the property is currently being used to stockpile several million cubic yards of soil for use by Robertson's. This soil is currently covering property that was formerly occupied by most of the storage bunkers. Aggregate wash (desilting) ponds were constructed in 1999, during the initial start-up of the aggregate processing operation at the site. Pond construction occurred within an approximately 30-acre area along the eastern edge of the future MVSL Unit 5 expansion area and involved removal and processing of alluvial soil to create five contiguous pond areas that extended to depths of up to 80 feet. While aggregate wash water discharged

to these ponds was once significant, a belt-press soil dewatering system was installed in 2002 and the ponds are no longer in active use.

Review Comments

1. In order to evaluate whether perchlorate might be present in the soils and debris generated from the demolition of the former bunkers, 13 borings were advanced and 4 backhoe test pits were excavated in three specific areas where some of the soils and debris were believed to have been placed. These areas included two segments of the berm that had been constructed around the aggregate processing plant, and an area within the aggregate processing plant. A backhoe was used in areas that the drill rig could not access. Drilling was performed by GLA's drilling subcontractor, A-Roy Drilling, using a 24-inch diameter bucket-auger drill rig to extend the borings through the fill materials to approximately 5 feet into native soils, unless refusal was encountered. These borings and pits extended to depths ranging from 5 to 30 feet and allowed for collection of soil samples for laboratory analysis. Soil samples were routinely evaluated for perchlorate, using USEPA Method 314.0, and VOCs, using USEPA Method 8260. Where perchlorate was detected, the laboratory testing program was expanded to include semi-volatile organic compounds (Method 8270) and explosives (Method 8330). As shown on Tables 2 through 16, a total of 57 soil samples were collected and delivered to the laboratory for analysis. Perchlorate was detected in only a few soil samples, above the laboratory method detection limit (MDL) of 0.03 mg/kg but below the laboratory practical quantitation limit (PQL) of 0.4 mg/kg. Based on these results, we consider this phase of the investigation complete, and no additional investigation or cleanup is requested at this time.

2. Considering the historical use of the bunkers that were present in the former aggregate wash pond area, five deep soil exploratory borings (DB-1 through DB-5) were advanced through the wash ponds in order to evaluate whether a residual source of perchlorate might exist in soils in this area. These boring locations coincided with the five separate ponds that had been developed on the property. Relatively undisturbed soil samples were collected at 20-foot maximum vertical intervals using a California modified split-spoon sampler. Borings were terminated when free groundwater was detected. Groundwater samples were obtained directly from boreholes after purging at least three casing volumes of water. Soil and groundwater samples were delivered to the laboratory for analysis of perchlorate and VOCs. A total of 86 soil samples were collected and analyzed. Laboratory analysis detected a trace amount of perchlorate (0.093 mg/kg) in sample DB-5/16 at a depth of 381 feet. TCE was detected in only two soil samples, DB-2/18 and DB-4/15 at concentrations of 0.0087 mg/kg and 0.0016 mg/kg, respectively. The only other VOCs detected in soil samples were styrene, 1,2,4-trichlorobenzene and methylene chloride at trace concentrations. Methylene chloride is a common laboratory contaminant. Perchlorate was detected in groundwater samples obtained from three of five borings. Perchlorate was detected in DB-2 at 1.3 µg/l at the groundwater surface, in DB-4 at 2.1 µg/l in a perched water zone (360 feet below ground surface) and at 130 µg/l at the groundwater surface, and in DB-5 at 340 µg/l at the groundwater surface. A total of nine VOCs were detected in groundwater samples. TCE was detected in groundwater surface samples obtained from four of the five borings at concentrations up to 140 µg/l. PCE was detected in the same samples at concentrations up to 8.0 µg/l. Therefore, it is apparent that perchlorate and

VOC source areas exist in the MVSL Unit 5 expansion area. It appears that further investigation of the MVSL Unit 5 expansion area at this time would be significantly hindered by the presence of an enormous amount of stockpiled soil on a large portion of the area, and the presence of the Robertson's facility. However, pending the findings of several field investigations being conducted by other suspected perchlorate dischargers on, and immediately south of, the eastern area of the MVSL Unit 5 expansion area, the County may be required to conduct further soil and groundwater investigations in this area in the future. In addition, we are aware that the Department of Toxic Substances Control is currently discussing further investigation of a portion of this area with the County.

3. The nature and extent of perchlorate impacts to groundwater from the former bunker area were investigated in accordance with the project work plan. This phase of investigation was conducted between August 3, 2002 and August 22, 2003, and included the construction of 13 new monitoring wells to depths ranging from 355 to 630 feet below ground surface. Section 7 of the evaluation report provides a comprehensive discussion of this phase of the investigation. In summary, in order to evaluate the vertical distribution of perchlorate and VOC impacts, temporary wells were installed and sampled within discrete hydrostratigraphic intervals within each borehole. During the drilling phase, Board staff was in communication with GLA staff and reviewed the well construction status reports that were provided for each monitoring well. Once the vertical extent of perchlorate and VOC impacts at each location had been defined, permanent groundwater monitoring wells were installed in the hydrostratigraphic interval where the most significant impacts were identified in the temporary wells. Prior to placement of permanent wells into the "Intermediate Aquifer" (B Zone), construction of 2-inch diameter piezometers was completed in the deeper "Regional Aquifer" (C-Zone). Piezometers were installed in this unit to permit long-term measurement of groundwater elevations in both the Intermediate and Regional Aquifers at the same time. The evaluation report concludes that the data obtained from these wells indicate that the plume emanating from the Unit 5 expansion area ends approximately 4,000 feet from the expansion area, near monitoring well N-9.

   Based on the analytical data obtained from groundwater samples collected from the monitoring wells located along the axis of the contaminant plume, it is apparent that the presence of TCE, 1,1,1-trichloroethane (1,1,1-TCA) and 1,2-dichloropropane (1,2-DCP) in the monitoring wells, including the downgradient most monitoring well, N-10, is a result of a VOC plume emanating from the Unit 5 expansion area. The trend of decreasing VOC concentrations in monitoring wells along the axis of the plume is indicative of a southeasterly plume advancing in the direction of City of Rialto Well No. 3. Also, the perchlorate that is present at the location of the downgradient most monitoring well, N-10, in concentrations that are about twice that found at the location of monitoring well N-9, which is located approximately 1,900 feet upgradient of N-10, is likely a result of a pulsed release of perchlorate from the bunker area and not an indication of the County's plume ending in the vicinity of monitoring well N-9 and the "regional" plume being present in monitoring well N-10, as the evaluation report contends. In addition, the data from the location of monitoring well N-9 were obtained from a single sampling event from the temporary wells installed in the N-9 boring. As a result, since permanent monitoring well N-9 is dry in the screened interval where perchlorate was detected in the temporary well, the data from the initial single sampling event have not been verified. The data in the evaluation report are

not sufficient to reasonably substantiate your conclusion that the plume emanating from the Unit 5 expansion area ends in the area of monitoring well N-9. To the contrary, the data indicate that the plume emanating from the Unit 5 expansion area extends at least to the location of monitoring well N-10. A minimum of two additional monitoring wells upgradient of City of Rialto Well No. 3, downgradient of monitoring well N-10, is necessary to further define the extent of the plume emanating from the Unit 5 expansion area. These two wells should be located relatively cross gradient from each other. Depending on the data obtained from these wells, it may be necessary to replace monitoring well N-9 in the future if it remains dry.

4. In reviewing the analytical data for the eastern-most monitoring wells, N-1 and N-6, it appears that concentrations of perchlorate in monitoring well N-1 have been decreasing from approximately 35 µg/l to approximately 20 µg/l over the past ten consecutive sampling rounds. Considering the location of monitoring well N-1 (cross-gradient of the desilting ponds) and its distance from the desilting ponds (approximately 2,400 feet), it appears that infiltrating water, and probably the groundwater mounding associated with the ponds, may have hydraulically advanced some of the perchlorate cross gradient to the area of monitoring well N-1. Based on the low concentrations of TCE (approximately 0.9 µg/l to 1.5 µg/l) in groundwater samples collected from monitoring wells N-1 and N-6, and the absence of 1,1,1-TCA and 1,2-DCP, it appears that these two monitoring wells may roughly represent the easterly boundary of the impacted groundwater emanating from the portion of the bunker area located downgradient from monitoring well N-2 and the Robertson's Ready Mix facility. In order to sufficiently define the easterly boundary of the plume, at least three additional monitoring wells are necessary. One well should be located east of monitoring well N-1, one well east of monitoring well N-6, and one well between monitoring wells N-3 and N-1.

5. Based on our review of hydrogeological parameters identified in the U.S. Geological Survey's recently developed groundwater model of the entire Rialto-Colton Basin (Linda R. Woolfenden and Kathryn M. Koczot, 2001), it appears that GLA's three-dimensional groundwater model and selected hydrogeological parameters, specifically hydraulic conductivity values for the water-bearing sediments in the immediate and downgradient areas of the MVSL, are not representative of the local aquifers. For layer 3 (Intermediate Aquifer), GLA assigned a hydraulic conductivity of 40 feet per day in the northern portion of the model and 9 feet per day in the southern portion of the model. In contrast, the USGS (page 49) used hydraulic conductivity values that range between 35 to 80 feet per day. The hydraulic conductivity values used by GLA were significantly lower than those used by USGS, and would result in contaminants migrating a much shorter distance with respect to time than what actually may be occurring. Figure 20 on page 51 of the USGS report shows that an area of approximately four square miles immediately downgradient of the MVSL was assigned a hydraulic conductivity value of 80 feet per day. This area includes the locations of four impacted production wells (City of Rialto Wells No. 2, 4 and 6, and West Valley Water District Well No. 22). According to the USGS report, since there was no information or data available for the hydraulic conductivity of the Lower or Regional Aquifers (GLA's Layer 5), the hydraulic conductivity values were estimated to be one-fourth those of the intermediate aquifer (GLA's Layer 3). This generalization of hydraulic conductivity by USGS may be appropriate for the purpose of studying the general effect of artificial recharge in the

entire Rialto-Colton Basin in lieu of conducting more specific aquifer tests to determine more realistic values. However, for developing a model to evaluate groundwater flow and potential perchlorate transport in a specific part of the Basin, the GLA model requires additional verification of the hydrogeological parameters that were used, especially the hydraulic conductivity values. In addition, the hydraulic conductivity values used by USGS were not "developed" by USGS, but were values reported by Geosciences Support Services, Inc. (1994), based on empirical data from "selected" wells in the Rialto-Colton Basin. Due to the virtual absence of requisite field data for the study area, direct calculations of hydraulic properties of aquifers were not possible. Instead, an empirical method of determining the magnitude of the parameters was used to assess the overall ability of the local aquifers to yield water to wells. This method determined the theoretical value of transmissivity by relating transmissivity to the specific capacity of a well. Actual values of well yields and drawdown are typically obtained from driller's logs or from well efficiency tests conducted by local water purveyors or the Edison Company. Depending on the locations of the "selected" wells, and the empirical methods used, the values used by USGS from this other source may also represent hydraulic conductivity values that are lower than actual conditions that may exist in this specific study area. This factor, combined with GLA using hydraulic conductivity values significantly lower than those used by USGS, may have resulted in GLA significantly underestimating the length of the contaminant plumes.

In order to develop a groundwater model for the perchlorate and VOC plumes in the immediate vicinity of the former bunker area, and possibly extend the model to include the impacted wells in the Rialto-Colton Basin, a conceptual model report should be prepared and submitted. The hydraulic properties of the aquifers should be first reviewed and evaluated by a technical committee consisting, in part, of technical representatives of interested members of the Perchlorate Task Force. If sufficient data are not available to determine a realistic transmissivity value, additional data should be collected. Then, based on an acceptable conceptual model for the impacted area, a representative groundwater flow model can be developed.

In accordance with Item 2 of Cleanup and Abatement Order No. R8-2003-0013, you are directed to submit a work plan for the installation of at least five additional monitoring wells in the leading edge and along the easterly boundary of the perchlorate and VOC plume, as described above. You are also directed to submit a work plan for preparing a conceptual model report. These work plans are to be submitted by February 17, 2004, and shall include a proposed time schedule for completion of the tasks described in the work plans.

In addition, Items 3 and 4 of Cleanup and Abatement Order No. R8-2003-0013 require development and implementation of a remedial action plan for perchlorate that has been discharged from the County's property. The remedial action plan is required to be submitted within 60 days of notification that perchlorate "has been sufficiently defined." Although additional investigation is necessary at this point, it is clear, based on the investigation conducted to date, that remedial action is necessary. Therefore, we request that the County immediately initiate the process of developing a conceptual remedial action plan. The workplan required above should include a description of the steps and schedule to develop such a conceptual plan.

If you have any questions, please contact Ann Sturdivant, Chief of our SLIC/DoD Section, at (909) 782-4904 or Kamron Saremi, Project Engineer, at (909) 782-4303.

Sincerely,

for Gerard J. Thibeault
Executive Officer

Attachments: Evaluation Report Comments (6)

cc: w/o attachments:
Regional Board
Jorge Leon, SWRCB, Office of Chief Counsel

cc: w/ attachments:
Wendy Arano/Christine Brown, DTSC (Cypress Office)
Gary Lass, GeoLogic Associates (San Bernardino Office)
Inland Empire Perchlorate Regulatory Task Force Members (mailing list attached)

KS:GLA evaluation report comments 1/2004

Terry Tamminen
Agency Secretary
Cal/EPA

Department of Toxic Substances Control

Edwin F. Lowry, Director
5796 Corporate Avenue
Cypress, California 90630

Arnold Schwarzenegger
Governor

MEMORANDUM

TO: Christine Brown, P.E.
Hazardous Substances Engineer
Geology, Permitting and Corrective Action Branch
Hazardous Waste Management Program

FROM: Wendy W. Arano, R.G.
Engineering Geologist
Geological Services Unit
Geology, Permitting and Corrective Action Branch
Hazardous Waste Management Program

DATE: December 15, 2003

SUBJECT: COMMENTS REGARDING "EVALUATION OF PERCHLORATE IMPACTS TO SOILS AND GROUNDWATER NEAR FORMER BUNKER AREA, RIALTO, CALIFORNIA"

PCA 25045 SITE CODE 401087 WP 00 MPC

The Geological Services Unit (GSU) reviewed the above-referenced report that was prepared for the County of San Bernardino Solid Waste Management Division by GeoLogic Associates. The report is dated October 2003. Additionally, the GSU attended a meeting on November 18, 2003 with staff of the Santa Ana Regional Water Quality Control Board (RWQCB) and interested stakeholders to hear comments regarding the county evaluation. The RWQCB has requested that comments on the report should be submitted to them by December 15, 2003. The RWQCB will present comments to the county.

The San Bernardino County Solid Waste Management Division first monitored wells at the Mid-Valley Sanitary Landfill for perchlorate in 1997. The only detection reported at that time was in well F-6 at a concentration of 4.2 µg/l. During subsequent monitoring events from 1997 through July 2000, perchlorate was detected only two times in well F-6. During the remainder of 2000 through January 2001, the perchlorate in well F-6 increased to 250 µg/l. Since then perchlorate was also detected in well F-3 at the landfill. The detections of perchlorate in monitoring wells along the east side of the landfill and in municipal supply wells east and southeast of the landfill prompted the County Solid Waste Management Division to conduct a perchlorate investigation of the groundwater in the area of the landfill. The newly acquired Schultz Trust property, which is

approximately 120-acres northeast of Unit 2, was also the focus of a source area investigation because of its long history as a munitions storage bunker area and the manufacturing, storage, transporting, and disposal of explosives and fireworks.

Work summarized in the reviewed report includes: the literature and aerial photograph review, drilling and sampling shallow soil borings within stockpiled bunker debris, drilling and sampling of soil and groundwater from deeper soil borings near the aggregate wash ponds in the former bunker area, installation and sampling of groundwater monitoring wells both upgradient and downgradient from the former bunker area, and the development of a three-dimensional model to simulate groundwater flow and contaminant transport conditions in the area.

Comments

1. This report is signed on page 37 by four registered geologists. Certification of the report by at least one of the registered professionals should include their stamp and current California registration number.
2. The construction of well N-5 varies significantly from that of the other wells. As indicated in the text and in Appendix D (Monitoring Well Completion Summary), well N-5 has two screened intervals within a single well casing. The screened intervals are set from approximately 372 feet below ground surface (ft. bgs) to 402 ft. bgs and also from 442 ft. bgs to 472 ft. bgs. The analytical data for groundwater samples from well N-5 seems to indicate that dilution is occurring. This apparent mixing may also contribute to cross-contamination of flow zones. Well N-5 should be properly abandoned as soon as possible. A properly constructed well pair with discreet screened intervals should be built to conduct monitoring in place of the current well N-5. A workplan for the abandonment and reinstallation of well N-5 should be submitted to regulatory agencies.
3. Figures showing the groundwater elevation and equipotential contours should include only data that is collected from wells that have been gauged within approximately two weeks of each other. The figures included in this report show groundwater contours based on data for first groundwater during drilling and in some cases elevation data that has been measured months apart. This is not an acceptable practice and could result in misinterpretations of the flow direction and groundwater elevation.
4. Organize the discussion of the analytical results according to the different flow zones. On Figure 8, the schematic cross-section shows a regional interpretation of the Upper Aquifer, Intermediate Aquifer, and Regional Aquifer, and aquitards in between. The discussion of "Local Conditions" in section 3.4.2 of the report indicates that the local conditions reflect the regional interpretation. Discussion of

the analytical results, then, should obviously indicate what concentrations are encountered in which flow zones.

5. The report does not discuss the survey of the newly installed wells and the survey data is not included on the boring logs, however, elevation and northings and eastings are reported on the Monitoring Well Completion Summary forms in Appendix D. The report should include a brief discussion of the survey procedure and the accuracy and certification by a licensed land surveyor.
6. Soil analytical results for shallow borings are included in tables 2 through 16. Figure 10 shows a B-5 and a B-6, but the tables do not include results for these borings and they are not discussed in the text. These borings should be included in discussion in the text and tables.
7. Data for a soil sample from boring B-13-A is included on Table 12. Discussion of how this boring is related to B-13 should be included in the text or as a footnote to the table.
8. Table 30 includes data for soils from "Well N-5 Bulk". There is a row for "depth", but no depths recorded. This table should include a description of depths of the soil samples.
9. Data from the "DB" borings should be included on the A-A' cross-section.
10. The cross-sections should indicate the interpretation of the various flow zones, as indicated on the schematic cross-section in Figure 8.
11. Robertson's Water supply well has approximately 400 feet of screened interval that may correspond to the lower part of the "Intermediate" (B-zone) Aquifer and into the "Regional" (C-zone) Aquifer. This well is located within or near a suspected source area for perchlorate contamination and groundwater nearby is know to contain perchlorate. Robertson's supply well should not be used for monitoring purposes because the length of the well screen allows only non-discreet sampling. This well should be properly abandoned as soon as possible.
12. Additional groundwater investigation is needed, especially in the area downgradient and cross-gradient of N-10.
13. Additional investigation of possible source areas within the former bunker areas should be completed. A figure should be created that shows the relationship of the soil borings to the former bunkers. For instance, where is DB-5 in relationship to the structures shown on Figure 9?
14. Locations of city supply wells are shown on Figure 12 and the text discusses concentrations of perchlorate that have been detected at those wells, but no information is provided on the method of sampling the city wells or on the screened intervals.

15. Groundwater modeling should be validated by comparison to observed concentrations and flow data.

This final comment is as you noted in your e-mail to me on December 15, 2003:

16. Section 6.3, Laboratory Analysis. Analyses for EPA methods 8330 and 8270 should have been run for all boring locations, not just those where perchlorate was detected. Due to different patterns of usage, perchlorate and explosive chemical contamination may not be co-located. EPA Method 8330 should have been run for all groundwater samples. Results of the analyses should have been discussed in the report. Additional future sampling events should include these analyses.

During the meeting on November 18, 2003 RWQCB staff indicated that although some revisions may be needed to the report and to the model, and while additional characterization may be needed to complete the investigation, remediation should be planned and implemented as soon as possible. The GSU agrees that implementation of a remedial option is the end goal and should proceed as soon as possible. If you have any questions or comments please telephone me at (714) 484-5480, or e-mail me at warano@dtsc.ca.gov.

Peer reviewed by: Jose Marcos
cc.: Fred Zanoria, CEG, CHG

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2003 DEC 23 PM 3:49

Memo

To: Kameron Saremi

From: Mark Slatten, RG/CEG, CHG/GP, David J. Leu, Ph. D.

CC: Dr. David Leu, The Leu Group; Gene Tanaka, Best Best & Kreiger LLP; Danielle Sakai, Best Best & Kreiger LLP

Date: 12/15/2003

Re: Comments on *Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California* by GeoLogic Associates, 2003.

This document is divided into two sections – General Comments and Specific Comments. With one exception, The Leu Group has not duplicated comments made in writing by Komex November 17, 2003. We have reviewed their comments and are in general agreement with those comments.

The Leu Group General Comments:

1) The document limits liability to within 4,000 feet of the assumed source. As such, important assumptions are made that are not scientifically defensible (examples follow in next section).

2) The Leu Group does not agree with the implied assumption that releases from the area of the MVLF (which includes the "Bunker Areas") occurred *only* during, or later than, 1999.

3) GeoLogic provides no clear site conceptual model as a framework for the discussions of horizontal or vertical groundwater movement. This is a fundamental step in trying to understand data for the area. No valid conclusions can be made unless a site conceptual model is put forth which addresses such features as the boundaries of the area of interest, the hydrostatic units and

properties, water budgets, sources and magnitudes of inflows and outflows, definition of the flow system (i.e., conceptualize how the movement of groundwater goes on), etc,

Specific Comments

1) Page 4, paragraph 3 – There is a mixup on the discussion of the order of well installations. Is Well F-15 part of the initial EMP?

2) Page 10, paragraph 3 & other places - The word "data" is plural.

3) Page 10, paragraphs 3 & 4 – This discussion of the USGSs water-bearing units is inaccurate and misleading. There are *four* water-bearing units defined in Woolfenden and Khadim, 1997. The *river-channel* deposits underlie the present channels of the active braided-stream courses (Lytle Creek, Santa Ana River). The *upper water-bearing* unit is present throughout the Rialto-Colton Basin and consists largely of alluvial fan deposits that grade into older river-channel deposits. The significance of the upper water-bearing unit is that it is highly permeable and allows the free infiltration of precipitation, streamflow, and imported water to the water table.

4) Page 11, paragraph 1 – GeoLogic makes reference to a "*Regional Aquifer*" in this paragraph. TLG believes that the aquifer discussed has not been adequately defined (by drilling, geophysical correlations, or geologic cross-sections) to demonstrate that the aquifer is "regional" in extent. Since none of the wells installed during this investigation penetrated the "Regional Aquifer" (paragraph 4), the lower boundary with the lower water-bearing unit is undefined. Clearly the "Regional Aquifer" is undefined and this is important in understanding groundwater (and contaminate) movement.

5) Page 11, paragraph 4 – Again, the USGSs definition of water-bearing units is misrepresented. The "lower water-bearing unit" does NOT consist of "..consolidated Tertiary marine sedimentary deposits". The lower water-bearing unit is an extensive unit consisting of sand and clay that is UNDERLAIN by consolidated non-water-bearing deposits.

6) Page 23, Table column 5 – TLG questions the value of a groundwater sample from a regional aquitard, which, by definition, separates two aquifers.

7) Page 35, paragraph 5 - Mass load data implies a single release event, an assumption that leads to an oversimplification of the data. To assume the center of mass of the contaminate has moved only 4,000 feet is to ignore the fact that, at a velocity of 5 feet per day (page 29), the contaminate may have traveled over 10,000 feet.

ATTORNEY-CLIENT PRIVILEGED WORK PRODUCT

FAX COVER SHEET

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DATE: November 17, 2003
PROJECT: FWC, WVWD: Perchlorate
FROM: Jon Rohrer
E-MAIL: jrohrer@losangeles.komex.com

	TO	AT	FAX
	Mr. Gerard Thibeault	SA-RWQCB	(909) 781-6288
	Mr. Kurt Berchtold	SA-RWQCB	(909) 686-8016
	Ms. Ann Sturdivant	SA-RWQCB	(909) 781-6288
CC;	Steven J. Elie	MP&G	(213) 624-1376

SUBJECT: Letter with Action Points following Review of October GLA Report: MVSL

PAGES (INCL. COVER): 4 — Missing pages? Call (714) 379 - 1157

ORIGINAL TO FOLLOW: [ ] NO [X] YES, will follow by: Mail: 12/01/03

PRIVILEGED AND CONFIDENTIAL

MESSAGE

Please find attached a letter submitted by Komex on behalf of the Fontana Water Company and the West Valley Water District detailing eight action points following the Preliminary Review of the October 2003 Report by GLA Associates RE the San Bernardino County Mid-Valley Sanitary Landfill.

Please do not hesitate to contact me if you have any questions.

Thank You,

Jon Rohrer

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ENVIRONMENT AND WATER RESOURCES

November 26, 2003

Santa Ana Regional Water Quality Control Board
3737 Main Street, Suite 500
Riverside, CA 92501

Attn.: Mr. Gerard J. Thibeault and Mr. Kurt Berchtold

Re: Action Points Following Preliminary Review of October 2003 Report by GeoLogic Associates Titled, *Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California*

Dear Mr. Thibeault and Mr. Berchtold:

With reference to our meeting of November 18, 2003, this letter presents eight points which require the most imperative action following our review of the above document (the Report). For further details of each of the points listed below please refer to the Preliminary Review of October 2003 Report by GeoLogic Associates Titled, *Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California* dated November 17, 2003. Komex is providing these technical comments at your request in our role as hydrogeologic and engineering consultants to the Fontana Water Company and the West Valley Water District.

1) Additional groundwater characterization needs to occur to the east, southeast, and southwest of Well N-10 in both the Intermediate and Regional Aquifers to verify the assertions regarding the extent of contamination made in the Report. Both discrete depth groundwater sampling should be performed and appropriately screened multiple-level or nested wells should be installed. This and all other future subsurface investigation activities should include geophysical borehole logging.

2) Further investigation of perchlorate contamination of the Intermediate and Regional Aquifers needs to be performed to the east of the Mid Valley Sanitary Landfill (MVSL) Unit 5, beyond Wells N-1 and N-6, to validate the "hypothetical plume" hypothesis. It is recommended that at least three sets of appropriately screened

multiple-level or nested wells should be installed to the east of the MVSL Unit 5.

3) Water level, lithology and well completion data for wells with two screened sections in the Intermediate Aquifer (Wells N-5, N-6 and N-7) should be reviewed to assess whether these wells may be causing cross-contamination of the Intermediate Aquifer. If these wells serve as conduits, they should be abandoned and replaced with as many separately completed, or correctly designed multiple-level wells as necessary to provide adequate vertical coverage of the Intermediate Aquifer at locations of interest.

4) A replacement Intermediate Aquifer well for Well N-9 screened from 460 to 472 feet below ground surface (bgs) must be drilled as soon as possible. The lateral location of Well N-9 is critical for understanding the extent and trend of contamination that has been, or is being released from beneath the MVSL. This Intermediate Aquifer well could be drilled at a location near Well N-9 and should include two separate wells, or a properly installed multiple-level well, with screened sections located equivalent with the depth from 460 to 472 feet bgs and below 472 feet bgs.

5) A continuous water level monitoring program should be developed for at least four wells in the Intermediate and Regional Aquifers to provide a better understanding of the hydraulic processes operating in these aquifers. Water levels should be measured using pressure transducers attached to dataloggers, and this requirement should be included in an updated monitoring and reporting program which also includes monthly water level measurement at all relevant wells (not just the N-1 through N-10 series wells).

6) A conceptual model report should be prepared which, together with further data collection, can be used to identify data gaps, guide future investigation activities, serve as a basis for evaluating remedial alternatives and aid in the preparation of any numerical groundwater model.

7) Further vadose zone/perched zone characterization of all areas where potentially contaminating activities occurred beneath MVSL Unit 5 must be completed so vadose zone remediation can be designed before more contamination reaches the Upper or Intermediate Aquifers. This specifically should include at a minimum, appropriate investigation of each of the former bunkers beneath MVSL Unit 5. Any boreholes in the vicinity of MVSL Unit 5 deeper than 15 feet bgs should be logged using a neutron probe.

8) All current and historical data needs to be made available to aid in the review of the Report and so that a meaningful conceptual model can be developed. In particular, a complete compilation of soil and groundwater perchlorate data, borehole and well logs and groundwater level measurement data should be submitted in one volume to facilitate review of data.

CLOSING

We and our clients appreciate the time you and your staff took to meet with us on November 18th and hope that these important comments are incorporated in a directive related to further investigation of perchlorate emanating from the MVSL. We look forward to continuing to work with the RWQCB on behalf of the Fontana Water Company and West Valley Water District to review characterization and remediation activities and proposals in the interest of expediting the characterization, minimization of impacts, and the ultimate restoration of the impacted drinking water aquifers.

Sincerely,
KOMEX

Jon Rohrer, R.G. 6881, C.Hg. 718
Vice President/Hydrogeologist

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Mr. Kamron Saremi. P.E.
Associate Water Resources Control Engineer
California Regional Water Quality Control Board, Santa Ana Region
3737 Main Street, Suite 500
Riverside, California 92501-3339

VIA FACSIMILE AND FEDERAL EXPRESS

Subject: Replacement for 12 December 2003 Comment Letter
Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California, October 2003

Dear Mr. Saremi:

GeoSyntec Consultants, Inc. (GeoSyntec), transmitted on behalf of the Goodrich Corporation (Goodrich) and at the direction of Manatt, Phelps & Phillips, LLP, a letter dated 12 December 2003, commenting on the October 2003 report titled *Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California* (Report). A stamp bearing the marks of "DRAFT - For Discussion Purposes Only" and "Privileged and Confidential Attorney-Client Communication and/or Attorney Work Product" was inadvertently on the letter. To avoid confusion, a replacement copy of the letter is being provided, without the stamped marks. We respectfully request that the previous version, bearing the stamp, be discarded and that the replacement version be admitted to the project file.

If you have any questions regarding these comments, please contact me at (626) 449-0664 ext. 201.

Sincerely,

Karen E. Arteaga, P.E.
Senior Engineer

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Copy to: Kurt Berchtold, Regional Water Quality Control Board, Santa Ana Region
Bruce Amig, Goodrich Corporation
Peter Duchesneau, Esq., Manatt, Phelps & Phillips, LLP
Joel Moskowitz, Esq., Moskowitz, Brestoff, Winston & Blinderman

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12 December 2003

Mr. Kamron Saremi. P.E.
Associate Water Resources Control Engineer
California Regional Water Quality Control Board, Santa Ana Region
3737 Main Street, Suite 500
Riverside, California 92501-3339

VIA FEDERAL EXPRESS

Subject: Technical Comments
Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California, October 2003
Prepared by GeoLogic Associates for the County of San Bernardino

Dear Mr. Saremi:

On behalf of the Goodrich Corporation (Goodrich) and at the direction of Manatt, Phelps & Phillips, LLP, this letter has been prepared by GeoSyntec Consultants, Inc. (GeoSyntec), to provide comments on the October 2003 report titled *Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California* (Report). The Report was prepared by GeoLogic Associates (GLA) on behalf of the Solid Waste Management Division of the County of San Bernardino (County), regarding potential releases and downgradient migration of perchlorate from the former bunker areas identified as Unit 5 of the Mid Valley Sanitary Landfill (MVSL) expansion (Bunker Area). The Regional Water Quality Control Board (RWQCB) has requested that written comments regarding the Report be submitted by 15 December 2003. This letter has been prepared in response to that request. Although Goodrich has identified various detailed concerns related to the modeling inputs, parameters, methods and simplifications, this letter focuses only on several fundamental assumptions which form the basis of the model and the conclusions derived from the model.

Points of Agreement

In general, Goodrich is in agreement with several key basin characterization assumptions that comport with the research conducted by the U.S. Geological Survey (USGS) in the region, namely the following:

- The Rialto-Colton Basin is hydraulically distinct from the Chino Basin by virtue of a geologic fault, the Rialto-Colton fault, which separates the two basins. The separation between the two basins is supported by (i) groundwater elevation measurements and (ii) analytical results from groundwater samples collected in the two basins. Groundwater elevation data indicate that groundwater flow within the Rialto Basin generally is from the northwest to the southeast, parallel to the fault. Groundwater analytical data from two wells recently installed by the County between the MVSL and the Rialto-Colton fault (S-1R and S-2, Figure 12 of Report) indicate non-detect concentrations for perchlorate in those locations, supporting the separation of the Rialto-Colton Basin from the Chino Basin with respect to perchlorate impacts.

- The hydraulic conductivity used in the modeling effort to represent the B Zone aquifer is within a reasonable range for the northern portion of the basin, although it may be somewhat at the high end of the range. Generally, the rates are consistent with those used by USGS in its modeling efforts for the region. Based on this range of hydraulic conductivity and the resulting groundwater flow velocities, Goodrich concurs with the broad implications of the model that any releases of perchlorate in the northern Rialto area have not have migrated to the southern end of the Rialto-Colton Basin.

Based on the points of agreement above that the Rialto-Colton Basin and Chino Basin are separated from one another and that releases, if any, from the northern

Rialto area have not impacted the southern Rialto-Colton Basin, it is likely that other sources of perchlorate exist in both basins but are not currently being investigated by the RWQCB. Thus, Goodrich encourages the RWQCB in its efforts to expand the investigation of perchlorate to other source areas.

General Concerns

In addition to the general points of agreements with the model that are outlined above, Goodrich raises several general concerns with respect to the modeling effort as follows:

- The use of the time periods 1975 to 1985 (in the two-stage release scenario) and after 1999 (in both release scenarios) employ selective use of the available information on historical operations in the area. The release scenarios described in Section 8.2 of the Report do not account for the 60-year history of operations within the Bunker Area, including but not limited to:

  - The Rialto Ammunition Storage Point, which was operated by the U.S. military in the mid-1940s and is reported to have disposed of munitions waste in on-site pits in the Bunker Area;

  - The Broco facility, believed to have begun operations in the 1950s, which is known to have operated a commercial open burning / open detonation pit in the middle of the Bunker Area;

  - Celebrity Fireworks, which manufactured fireworks with perchlorate in the Bunker Area until an explosion in 1987 closed the plant.

- Operations at adjacent parcels, including to the east and north of the Bunker Area, have involved perchlorate use both historically and currently and are not accounted for in the model.

- The effects of the spreading at the Robertson's Ready Mix, Ltd., operations are not well documented in the Report and do not appear to have been addressed in the model. Particularly, mounding effects and the potential alteration in groundwater flow direction due to the recharge have not been addressed. An evaluation of the impacts of the mounding on analytical results at potentially affected wells (e.g., F-3, F-6) has not been presented.

- Further investigation is necessary to assess the nature of the impacts at monitoring well N-10. The Report asserts that the perchlorate impacts at monitoring well N-10 are unrelated to a potential release associated with the former bunkers, a position that is not well supported. For example, the groundwater analytical data for perchlorate coupled with the hydrogeology of the region, particularly the groundwater flow direction, support a connection between the former bunkers and perchlorate impacts at monitoring well N-10. The conclusion in the Report that there is no connection between N-10 and the bunkers appears to ignore that well N-10 is hydrogeologically downgradient of the Bunker Area and that the former operations in the Bunker Area are logical potential sources for the perchlorate found in well N-10.

- Further characterization is required to evaluate the downgradient extent of the plume beyond well N-10.

While the concerns outlined about are not exhaustive, Goodrich believes that these concerns should be further assessed as they relate to the migration of perchlorate from the Bunker Area. Further comments on the modeling may be presented if and

when the electronic data files associated with the modeling effort summarized in the Report are provided.

If you have any questions regarding these comments, please contact me at (626) 449-0664 ext. 201 or Mr. Bruce Amig of Goodrich at (704) 423-7071.

Sincerely,

Karen E. Arteaga, P.E.
Senior Engineer

Copy to: Kurt Berchtold, Regional Water Quality Control Board, Santa Ana Region
Bruce Amig, Goodrich Corporation
Peter Duchesneau, Esq., Manatt, Phelps & Phillips, LLP
Joel Moskowitz, Esq., Moskowitz, Brestoff, Winston & Blinderman

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City of Rialto
California

December 15, 2003

State Water Resources Control Board
Attn: Kurt Berchtold
Ann Sturdivant
3737 Main Street, Suite 500
Riverside, CA 92501

Subject: Review of GeoLogic Associates Report Entitled "Evaluation of Perchlorate Impacts to Soils Near the Former Bunker Area Rialto, CA, October 2003"

Dear Mr. Berchtold and Ms. Sturdivant:

The City of Rialto herewith transmits our review of the October 2003 GeoLogic evaluation of perchlorate impacts to soils near the former bunker area in Rialto, CA. Based upon the review of this document by our consultant, Daniel B. Stephens & Associates, and others representing surrounding water agencies, it seems clear that the County of San Bernardino has much additional work to do.

We hope that the California Regional Water Quality Control Board continues to insist on a top quality scientific study of the problem and its source areas. We also look forward to your demand that the responsible parties complete their studies and follow through with the remediation of the perchlorate at its source and throughout the Rialto-Colton Basin.

Sincerely,

Brad Baxter,
Director of Public Works

CC: Susan Trager
Christian Carrigan

Review of GeoLogic Associates Perchlorate Evaluation Report

On behalf of the City of Rialto, Daniel B. Stephens & Associates, Inc. (DBS&A) has reviewed the October 2003 report by GeoLogic Associates titled *Evaluation of Perchlorate Impacts to Soils and Groundwater Near Former Bunker Area, Rialto, California* ("Report"). The Report addresses delineation of perchlorate in soils and groundwater at the Mid-Valley Sanitary Landfill (MVSL) former Bunker Area and in a contaminant plume extending beyond the landfill boundary. This document presents DBS&A's preliminary evaluation of the Report and contains our major comments related to the investigation itself, quality issues related to Report preparation, analysis and interpretation of investigation results, and the overall conclusions drawn by GeoLogic.

Based on our evaluation of the GeoLogic Report, we found the investigation inadequate to determine the nature and extent of past and potentially ongoing releases of perchlorate from MVSL. In addition, there are significant flaws and shortcoming in the analysis and interpretation of data presented in the Report, including mass loading calculations and modeling. The investigation and supporting analysis are inadequate to conclude that releases of perchlorate from MVSL do not extend more than 4,000 feet downgradient of the Bunker Area and are inadequate to conclude that releases of perchlorate from MVSL did not impact Rialto supply wells. In addition, the Geologic study area is too narrowly focused on the Bunker Area. In fact, the data is insufficient to conclude that the landfill itself, in particular Unit 1, does not contribute perchlorate to the Rialto-Colton groundwater basin. Our major comments are summarized below.

1. The Report does not provide a comprehensive conceptual model of MVSL which should consider all available information and address the following:
   - History of landfill operations
   - Description of stormwater management features (e.g., landfill cells and stormwater basins are potential recharge sources that may mobilize contaminants)
   - Description of all potential perchlorate source areas, including past leachate from landfill Unit 1
   - Comprehensive description of hydrostratigraphic units, including perched zones

- Historical chemical data, including perchlorate, solvents, and landfill gas
- Historical groundwater flow directions
- Contaminant migration pathways

The absence of a solid conceptual model prohibits valid interpretation of study results, determination of remaining data gaps, and development of a remedial strategy that will prevent further contamination of the water supply in the Rialto-Colton basin. Groundwater flow and transport modeling should not be undertaken until a solid conceptual model has been developed. The modeling presented in this Report appears to have been hastily conducted and lacks a solid scientific foundation.

2. The Report lacks a comprehensive description of groundwater flow directions. The potentiometric surface maps provided (Figures 13 through 15) are based on data collected during drilling or at different times. Contouring data collected during drilling or from different time periods is inappropriate and does not follow standard scientific practice.

   Historical groundwater elevation data and interpreted groundwater flow directions are not provided. Sources of recharge at the landfill likely changed over time and would have influenced groundwater flow directions. Recharge from MVSL stormwater ponds and from the aggregate wash process would likely have created a water table mound, raising the water table locally, altering the flow direction, and steepening the hydraulic gradient near the recharge areas. Recharge from these features also would have lead to mobilization of perchlorate and other contaminants from the vadose zone beneath them. In addition, temporal changes in municipal supply well pumping and other significant pumping in the area (e.g., remediation wells) would lead to changes in groundwater flow directions and velocity.

   The Report assumes a generally constant groundwater flow direction and velocity for the purposes of determining where perchlorate would migrate from the Bunker Area and how far it would travel. Given the variability in groundwater flow direction discussed above, this assumption is invalid.

3. The Report lacks sufficient discussion and presentation of historical chemical data. The Report should include tables summarizing historical data including perchlorate data from 1997, VOC data (including trichloroethene [TCE] and tetrachloroethene [PCE] data referenced in discussion of TCE/PCE ratios), leachate data, and landfill gas monitoring data. A careful examination of leachate and VOC sampling in both groundwater and landfill gas will facilitate our understanding of source areas at the landfill and probable migration pathways for perchlorate.

4. The discussion of a correlation between perchlorate and TCE occurrence and TCE and PCE occurrence (pages 31 and 33) is debatable. Although a careful examination of VOC data may help us understand the potential migration patterns and pathways for perchlorate, the chemical properties, transport behavior, and degradation behavior will be different for perchlorate relative to individual volatile organic compounds (VOCs), including TCE and PCE. Therefore, ratios and correlations between perchlorate and TCE may not be constant temporally or spatially. Differences in source timing and relative source strength also should be considered when interpreting correlations between chemicals. The GeoLogic analysis does not account for these differences and is therefore highly speculative.

5. GeoLogic's Figure 16 showing perchlorate results from temporary monitor wells is misleading. The figure should indicate the screened intervals of the supply wells relative to the temporary monitoring wells. Supply wells normally cannot be used to delineate the extent of impacts because concentrations in supply wells are diluted in comparison to monitor wells due to larger screened intervals and capture zones. In addition, many of the supply wells are likely screened in much deeper portions of the aquifer that are not yet impacted by perchlorate. Therefore, the NDs noted at Robertson's Supply Well, Rialto Well #3, and Rialto Well #2 do not indicate that perchlorate is not present in these areas. In fact, a monitor well installed in the same location as the supply well but at an appropriate depth may contain perchlorate. In addition, the figure omits the perchlorate results for samples collected from the deep borings within the Bunker Area wash ponds. Perchlorate was detected at the groundwater surface in DB-5 at 340 µg/L and in a perched zone in this area. The presence of perchlorate in perched zones should be considered in the selection of remedy.

6. Maps showing perchlorate concentrations measured during the same timeframe in monitor wells screened in the same horizons should be included in the Report. Similar maps showing TCE and PCE concentrations would also be helpful.

7. We are concerned about the discussion of the multiple screens installed in the intermediate zone for wells N-5, N-6, and N-7. According to the discussion on page 30 of the Report, water samples collected in the upper intermediate screen contained elevated levels of perchlorate relative to the lower intermediate screen. But when the water level in the upper screen dropped below the finer-grained unit separating the two screens, perchlorate concentrations in the upper screened area dropped. This well (and the other multi-screened wells) may be acting as a conduit for downward migration of perchlorate.

   During the investigation, perched groundwater was encountered in many locations, including in deep borings in the wash pond area, as well as in several monitor wells at a depth above the intermediate aquifer. Wells should be screened in the uppermost water encountered, including perched groundwater. In addition, considering the probability that portions of the upper aquifer will resaturate during periods of heavy rainfall, it seems prudent to screen directly above the fine-grained unit separating the upper and intermediate aquifers. These wells will provide valuable information and act as sentry wells for continued releases of perchlorate likely still contained within the vadose zone in the area of the former bunkers. As previously stated, the presence of perched groundwater should be carefully considered in the design of an appropriate remedy.

8. Given the large spacing between monitor wells (more than 500 feet) and the large spacing between vertical intervals in the temporary wells, any calculation of mass loading will be highly uncertain. The mass loading calculation presented is highly tenuous due to the scarcity of data, variability in groundwater flow direction, and likely nonlinear, non-horizontal orientation of the plume centerline. The conclusion drawn (i.e., that the perchlorate plume migrated only 4,000 feet from the Bunker Area source) is therefore unfounded.

   In particular, given the variability in flow direction over time and the presence of downward vertical gradients, the assumption that the plume axis is a straight, horizontal line is invalid. Recharge from the aggregate wash ponds during their use between1999 and 2002 would

have likely created a water table mound, causing radial flow away from this area. This would have caused perchlorate to migrate radially away from the area, rather than to the southeast.

9. Perchlorate travel distance was calculated by GeoLogic based on a 1999 release in the Bunker Area and an average groundwater velocity of 3 feet per day (ft/d). Given that hydraulic conductivity ranges up to 5 ft/d and that releases likely occurred in the Bunker Area prior to 1999, the expected travel distance was likely much higher than the 4,000 feet calculated by GeoLogic.

   In addition, releases of perchlorate from the Bunker Area likely occurred much earlier than the 1990s, perhaps as early as the 1940s when the bunkers were first installed by the U.S. military (GLA, 2003). We agree with GeoLogic that recharge caused by the aggregate wash ponds likely mobilized perchlorate in soil, leading to a pulse of high perchlorate concentrations in groundwater. Similarly, perchlorate likely released from the Bunker Area following its construction could be mobilized during periods of high rainfall or other recharge generating activities, leading to earlier pulses of perchlorate to groundwater. Therefore, it is plausible that perchlorate released from the Bunker Area traveled much farther than 4,000 feet.

10. The modeling presented in the Report appears to have been prepared in haste and is not based on a solid conceptual model. The modeling is based on several unfounded assumptions and in general is poorly developed and tested; therefore, any conclusions based on the model are highly speculative. Specific problems with the model include:

    - The model does not reasonably account for complexities of the hydraulic gradient. The model is run for two steady-state scenarios, ignoring dynamic changes known to occur in the hydraulic head configurations, which should be more accurately modeled in a transient approach.

    - Important pumping and recharge sources are either ignored or oversimplified in the modeling. These features are extremely critical to an accurate simulation of hydraulic conditions and contaminant transport. The model should account for (1) actual pumping

at the municipal supply wells, (2) MVSL remediation pumping and reinjection wells, (3) recharge for MVSL stormwater ponds, and (4) recharge from the aggregate process water ponds. Based on the model input parameters included in Table F1, it appears that the municipal supply wells were simulated using constant pumping, rather than considering monthly or annual pumping rates. Apparently, the MVSL remediation wells and areas of focused recharge (e.g., washing ponds) were not considered. In addition, it is not clear how the supply wells were simulated within the model (i.e., how were the supply well screens accounted for?).

- The groundwater flow model should be calibrated to transient conditions. Given the significant changes in groundwater head and the temporal variability in groundwater recharge and extraction, it is inappropriate not to conduct transient calibration.

- For simulating perchlorate transport, the dispersion coefficient was set to the MT3D default value. The default value is not stated in the Report, nor is any justification given for this selection. Given the importance of the dispersion coefficient in simulating transport, the dispersion coefficient should be selected based on the hydrogeologic regime and not just arbitrarily set to the default. This parameter deserves a more careful evaluation.

- The modeling simulates a single stage release originating in 1999 from the area of the aggregate wash ponds. However, the model fails to account for the high recharge probably associated with the wash ponds, which likely would have caused perchlorate to migrate radially away from the area, including to the east toward N-1. The lack of appropriate consideration of variable flow conditions makes it difficult to evaluate the potential for releases from the Bunker Area to impact wells farther to the east, such as N-1 and West Valley #22.

- As mentioned previously, samples from the water supply wells are inappropriate for delineating plumes without careful consideration of dilution issues and depth of screened intervals. Therefore, discussion of the absence of perchlorate at Rialto Well # 3 on page F-13 is inappropriate.

- We strongly disagree that the modeling results have shown that perchlorate from the Bunker Area did not reach N-10.

- Although we agree that areas north of the Bunker Area likely contributed perchlorate to the groundwater in the Rialto-Colton basin, the simulations provided in the GeoLogic Report are not based on a clear understanding of sources to the north and are highly speculative at this point.

11. The focus of the GeoLogic Report is investigation of releases of perchlorate from the former Bunker Area. We do not believe that the results of this and previous investigation can rule out the possibility that perchlorate was released from other areas of the landfill, including from Unit 1. Groundwater downgradient of MVSL Unit 1 has been impacted by leachate releases, based on monitoring data showing impacts of inorganic parameters that were transported to groundwater by landfill leachate. The leachate releases provide a potential mechanism for perchlorate to migrate from the landfill as well.

    Evidence of leachate impacts is illustrated by monitoring at well F-2 on the south end of Unit 1 and F-5 at the southeast corner of Unit 1. Water quality data tables in GeoLogic's 1997 *Evaluation Monitoring Program* report (GLA, 1997b) indicate that the initial monitoring at F-2 in 1994 detected a total dissolved solids (TDS) concentration of 1,010 mg/L. This was followed by a steady decline in TDS to concentrations of approximately 330 mg/L by 1996. TDS concentrations in F-5 increased from 1992 to a peak concentration of 600 mg/L in 1993, followed by a steady decline below 300 mg/L by 1995.

    These data show the transient nature of leachate impacts on groundwater and the aquifer's tendency to flush dissolved highly soluble constituents rapidly as a result of high flow velocities in the range of 4.4 to 5 ft/d (GLA, 1997a). Likewise, past releases of perchlorate from Unit 1 cannot be ruled out based on its current absence in landfill monitor wells, since it may have been transported downgradient and removed from the area nearest the landfill.

    Leachate generation at the MVSL is likely to have been much higher in the earlier years of landfill operation than it is today, because waste disposal operations were being conducted below grade, causing stormwater to pond on top of the waste areas that were the lowest

points in the cell at that stage of the operation. After waste placement moves above grade, stormwater runoff is shed off the waste, and leachate generation is likely to decrease. Therefore, leachate generation is likely to have been highest in the 1950s, 1960s, and 1970s, during the years when the disposal of hazardous wastes and wastes from nearby explosives handling and manufacturing facilities was unregulated. It is plausible that perchlorate, transported by leachate to the aquifer, may have migrated far downgradient of the MVSL by the time perchlorate monitoring was first conducted at the MVSL in 1997.

12. We have reviewed the letter provide by Komex on behalf of the Fontana Water Company and the West Valley Water District summarizing their preliminary comments on the Report and recommendations for further investigation. We agree with many of their comments, including in particular the Summary of Recommendations provided on pages 6 through 8. We concur that this additional investigation is necessary to properly delineate the nature and extent of past and ongoing impacts from the Bunker Area and to properly design a remedy that is protective of groundwater within the Rialto-Colton groundwater basin.

References

GeoLogic Associates (GLA). 1997a. *Proposed point-of-compliance corrective action program: Mid-Valley Sanitary Landfill, San Bernardino County*. Volume I. Prepared for NORCAL/San Bernardino, Inc., San Bernardino, California. May 1997.

GeoLogic Associates (GLA). 1997b. *Evaluation monitoring program, Phase I point-of-compliance study: Mid-Valley Sanitary Landfill, San Bernardino County*. Prepared for County of San Bernardino Waste System Division, c/o NORCAL/San Bernardino, Inc., San Bernardino, California. May 1997.

GeoLogic Associates (GLA). 2003. *Evaluation of perchlorate impacts to soils and groundwater near former bunker area, Rialto, California*. Volume I. Submitted to California Regional Water Quality Control Board – Santa Ana Region, Riverside, California. October 2003.

Komex. 2003. Letter from Jon Rohrer to Gerard J. Thibeault and Kurt Berchtold, Santa Ana Regional Water Quality Control Board, regarding Preliminary review of October 2003 report by GeoLogic Associates titled, Evaluation of perchlorate impacts to soil and groundwater near former bunker area, Rialto, California. November 17, 2003.

DANIEL B. STEPHENS & ASSOCIATES, INC.

Nicole T. Sweetland, Ph.D.
Senior Hydrogeologist

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ENVIRONMENT AND WATER RESOURCES

November 17, 2003

Santa Ana Regional Water Quality Control Board
3737 Main Street, Suite 500
Riverside, CA 92501

Attn.: Mr. Gerard J. Thibeault and Mr. Kurt Berchtold

Re: Preliminary Review of October 2003 Report by GeoLogic Associates Titled, *Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California*

Dear Mr. Thibeault and Mr. Berchtold:

This letter presents the results of a preliminary technical review of data, analyses, conclusions, and supporting documentation related to the October 2003 report titled, *Evaluation of Perchlorate Impacts to Soil and Groundwater Near Former Bunker Area, Rialto, California.* Komex is providing these technical comments in our role as hydrogeologic and engineering consultants to the Fontana Water Company and the West Valley Water District.

The subject document is herein referred to as the Report, and all portions of the County of San Bernardino (the County) Mid-Valley Sanitary Landfill are referred to as the MVSL. The Report was prepared by GeoLogic Associates (GLA) and submitted to the Santa Ana Regional Water Quality Control Board (RWQCB). The Report presents results of limited historical data regarding the MVSL and the surrounding area and recent investigation results and analyses associated primarily with investigation activities related to contamination of groundwater by perchlorate and other contaminants. Perchlorate and other contaminants have been detected in the drinking water aquifers beneath, and in the vicinity of the MVSL, and also in drinking water wells of our clients and others. This review should be considered preliminary as significant underlying data were not provided in the Report and comments, recommendations or technical evaluations may change upon review of these data.

Our review of this document should in no way be considered a validation of the document's contents or any portion of the document, including findings, interpretation, conclusions, or opinions expressed therein. If comments, corrections, or questions have not been provided for a respective sentence, paragraph, or section, this should not be construed as agreement with the information presented within that respective sentence, paragraph, or section.

In the following letter, technical comments and recommendations regarding data, analyses, conclusions, and recommendations contained in the Report are provided in three sections: 1) a summary of the most significant comments and recommendations; 2) sequential technical comments and/or recommendations following the format of the Report, excluding groundwater modeling; and 3) detailed technical comments and/or recommendations regarding groundwater modeling documented in the Report.

SUMMARY OF COMMENTS

1) Based upon review of the Report, we concur with the primary factual conclusions that: 1) soils in the former Bunker Area likely continue to be a threat to water quality in the area and; 2) groundwater aquifers that serve as a source of drinking water below and downgradient of the MVSL have been contaminated by elevated concentrations of perchlorate and a variety of volatile organic contaminants. It is acknowledged that the ultimate goal of characterization activities should be the design of remedial strategies for the vadose zone and drinking water aquifers, however given the lack of complete source zone and groundwater contaminant delineation, critical data gaps must be addressed before remediation starts to ensure that any remedial activity does not spread, or worsen contamination.

2) It is unlikely that contamination detected at Well N-10 is solely the result of "regional perchlorate impacts" or that groundwater contamination is limited to less than 4,000 feet from the MVSL. This comment is based upon the limited data that exist, the tenuous nature of groundwater levels (*e.g.* estimation of groundwater level elevations using data collected "during drilling"), groundwater quality data presented, and the method of analyses and modeling in the Report. The groundwater level data used to calculate groundwater gradients, data analyses of mass loading, aquifer test analyses, and groundwater model in the Report, as detailed further, all rely on assumptions or errors which introduce significant uncertainty to any assertion that "perchlorate impacts from near the former Bunker Area do not extend more than about 4,000 feet to the southeast (downgradient)."

3) Selective interpretations have been presented in the Report, which may lead readers to draw incorrect conclusions. This is most evident in Figure 17, which illustrates perchlorate mass per unit area at monitoring wells, contouring of perchlorate mass per unit area, and the results of one groundwater modeling simulation. As detailed later in this review, the mass per unit area interpretation technique used in the Report does not consider that many contaminant plumes are not linearly distributed geographically. As such, a more accurate interpretation of the downgradient plume would take this into account. Considering this, the plume could be interpreted to extend as far as, if not farther than, Well N-10, more than 4,000 feet.

More importantly in the groundwater modeling simulation illustrated on Figure 17, the plume % concentration values appear to be based on a starting concentration of 100 milligrams per liter (mg/L, or ppm). If this is the case, the lowest concentration gradation (blue 10-0) represents simulated concentrations on the order of 1 mg/L, or 1,000 micrograms per liter (ug/L, or ppb). In interpreting any information from modeling simulations on Figure 17, or any simulations presented in the Report, it is important to note that the Report does not document any method of matching modeled concentrations to real contaminant level data (*e.g.* sample concentrations at Well N-8 in the Intermediate Aquifer range from 67 to 267 ug/L, while the model result illustrates approximately 4,100 ug/L). Therefore, if Figure 17 were to show % of initial concentrations down to a level of 4 ug/L, the contamination from the MVSL would extend much farther than Well N-10. Evaluation of whether a 100 mg/L source term is appropriate should have been determined by those performing the modeling; however, this point highlights that any conclusions drawn on the presentation of modeled, or unitless, data need to consider the underlying assumptions and techniques made in presenting those results.

4) One major issue with analyses presented in the Report is the lack of a structured conceptual model to guide investigation activities, identify data gaps, and provide a starting point for quantitative or numerical analyses. Aside from previously noted issues with analyses in the Report, assertions that perchlorate which has come from or is currently emanating from within or beneath the footprint of the MVSL could not have impacted any drinking water wells, does not adequately consider activities undertaken by the County prior to 1999, or more than four preceding decades of potentially contaminating activities in the area now covered by portions of the MVSL. Most of the analyses presented in the Report assume that perchlorate was only released to the subsurface beneath the MVSL in 1999. This logic does not appear to consider important

information such as the detection of perchlorate between 1,400 and 3,960 milligrams per kilogram (mg/kg) in wipe samples collected from Bunkers D3 and C2 in 1998 (IT Corporation, 1998: cited in the Report). Because a relatively complex history of potentially contaminating activities exists beneath and in the vicinity of the MVSL, it is essential that a good conceptual model is used as a basis to evaluate groundwater contamination pathways, identify data gaps, and guide remediation measures.

5) It is difficult to provide a complete technical review of the Report because significant data upon which important fundamental analyses (such as groundwater gradients) are based were not clearly presented in a meaningful fashion, and selected data were interpreted. The data presentation comment includes, but is not limited to, a lack of groundwater level measurement data from which groundwater gradients were calculated. The comment regarding selected evaluation of data applies both to historical data as outlined in the previous comment and, most importantly, to significant data collected as part of the advancement, lithologic logging, soil sample collection and analysis, and groundwater sampling and analysis for soil borings DB-1 through DB-5 in the vicinity of the wash ponds. Lithologic data for soil borings DB-1 through DB-5 were not included on cross-sections and, more importantly, the potential significance of the detection of perchlorate in four of six groundwater samples collected from these soil borings at concentrations of up to 340 ug/L was not discussed in any significant detail. These detections of perchlorate generally occurred at depths of 412, 360, 411, and 403 feet below ground surface (bgs) in soil borings DB-2, DB-3, DB-4, and DB-5, respectively. As discussed previously, the Report lacks a clear, comprehensive conceptual model. Information such as the detection of perchlorate and other contaminants in perched groundwater beneath the former location of wash ponds, which were located on top of former bunker locations is important to consider in understanding the sources of contamination and in developing meaningful remedial strategies.

6) It is encouraging that GLA used geophysical tools in relation to the dry condition of the screen in Well N-9; however theses techniques were not used on any other wells or soil borings. Customary data collection techniques such as downhole geophysical logging should have been used as a standard part of all subsurface investigations deeper than 15 feet bgs. These techniques should be used with all investigation associated with the MVSL and other investigations to characterize perchlorate groundwater contamination in the Fontana-Colton-Rialto area. GLA reported difficulty in distinguishing between silty sands that might potentially act as aquitards and those that might perform as aquifers. Geophysical borehole logging using standard suites of tools can assist in

making such determinations and in correlating similar lithologies across distances. In addition, given the presence of perched zones, the previously saturated Upper Aquifer, and the elusive nature of perchlorate vadose zone contamination, neutron logging should be considered to measure moisture content in the vadose zone in all borings deeper than 15 feet bgs.

7) Although water level data for Well N-5 were not reported, this well may have been acting as a conduit for deeper contaminant migration within the Intermediate Aquifer. Water level, lithology and well completion data for wells with two screened sections in the Intermediate Aquifer (N-5, N-6 and N-7) should be reviewed to assess whether these wells may be causing cross-contamination of the Intermediate Aquifer. If these wells do have the potential to serve as conduits, they should be abandoned and replaced with as many separately completed, or correctly designed multi-level wells as necessary to provide adequate vertical coverage of the Intermediate Aquifer at locations of interest.

8) As noted earlier, beyond the comments related to major findings noted above, there are technical errors, incomplete explanations of analyses, or data and incomplete documentation of data upon which significant analyses or conclusions were based. Although documented later in this letter, this includes but is not limited to the potential mis-analysis of the 24-hour aquifer test at Well N-7. The analysis in the Report cites a steeper departure from the earlier rate of drawdown near the end of the pumping portion of the aquifer test.

   The maximum drawdown reported during the test was approximately 7 feet. Although neither the date and time of the aquifer testing nor the static water level elevation were illustrated with the aquifer test analysis, the water level elevation on July 25, 2003, was reported as 1,151.58 feet above mean sea level (AMSL). This is in relation to a reported ground surface elevation of 1538.69 feet AMSL, which equates to a depth to water of approximately 387 feet bgs. The two screened intervals for Well N-7 are between 375 to 395 and 405 to 410 feet bgs. If the static depth to water in Well N-7 prior to the 24-hour aquifer test was deeper than 388 feet, the water level in Well N-7 would have been drawn below the bottom of the first screen, and significant deviation from any predictable aquifer behavior would be expected. If this did occur, any estimates of aquifer properties by this method are invalid.

9) Although it may be that in the copy received for our review, a page may have been missing, but if not, it appears the Report was not stamped by a professionally registered geologist or engineer.

SUMMARY OF RECOMMENDATIONS

1) All relevant data not included in the Report should be submitted as soon as possible in an addendum to allow complete review and verification of some of the interpretations, such as groundwater gradients contained in the Report.

2) A separate conceptual model report should be developed based on the results of recent investigation activities documented in the Report, for all relevant historical data for prior uses of property now beneath the MVSL, for the MVSL itself, and for the results of ongoing monitoring and sampling. The conceptual model report should identify and prioritize data gaps that must be addressed to develop an adequate level of certainty regarding contaminant sources, fate, and transport, and to develop effective remediation strategies associated with contamination, which has come from, or is being released from beneath the MVSL.

3) Further vadose zone/perched zone characterization of all areas where potentially contaminating activities occurred beneath the MVSL must be completed so vadose zone remediation strategies can be designed before more contamination reaches the Upper or Intermediate Aquifers. This area should include the entire extent of MVSL Unit 5. The differential detection of chlorinated solvents and N-nitrosodimethylamine (NDMA) in the DB borings and near-site wells indicates a complex source history and distribution.

4) Additional groundwater characterization needs to occur to the east, southeast, and southwest of Well N-10 in both the Intermediate and Regional Aquifers to verify the assertions regarding the extent of contamination made in the Report.

5) Additional groundwater characterization needs to occur to the South of MVSL Units 5/2, in addition to additional characterization recommended within MVSL Unit 5. Although Well N-7 may indicate that perchlorate is not currently at elevated levels at this time in the aquifer, significant masses of perchlorate may be moving towards Well N-7 from within and beneath MVSL Unit 5. At least two well clusters should be installed along the southern boundary of MVSL Unit 2, in the vicinity of existing wells F-3 and F-10.

6) Further investigation of perchlorate contamination of the Regional Aquifer needs to be performed in the vicinity of Wells F-6A, N-3 N-8, N-6, and N-9. The detections of perchlorate in deeper Wells N-8 and N-10 appear to be valid. If the deeper groundwater gradient is oriented only slightly more toward the east than as depicted on Figure 15, there is no Regional Aquifer well downgradient of Well N-8 and contamination at Well

N-10 may also indicate that Intermediate Aquifer contamination from the MVSL is reaching the Regional Aquifer.

7) A replacement Intermediate Aquifer well for Well N-9 screened from 460 to 472 feet bgs must be drilled as soon as possible. The lateral location of Well N-9 is critical for understanding the extent and trend of contamination that has been or is being released from beneath the MVSL. This Intermediate Aquifer well could be drilled at a location near Well N-9 and should include two separate wells, or a properly installed multi-level well, with screened sections located equivalent with the depth from 460 to 472 feet bgs and below 472 feet bgs. If existing Well N-9 re-saturates, an aquifer test can be performed using either the new or existing well as an observation well to perform a more accurate aquifer test and to provide an estimate of aquifer storativity.

8) The potential for Upper Aquifer re-saturation should be considered during all future well installation activities and it may be prudent to install wells which may be dry upon installation, but could serve as Upper Aquifer monitoring points if water levels rise significantly.

9) Groundwater modeling should only be performed following preparation and validation of the conceptual model report listed above and data collection to address any significant data gaps. The modeling should include transient calibrations, as the hydrogeologic situation in the vicinity of the MVSL is very dynamic in terms of the changes in water level, complexity of boundary conditions, complexity of potential release histories, and well pumping. The contaminant transport modeling must also be validated with real world data.

10) A clear sampling, monitoring and reporting program should be developed for all wells associated with the MVSL. In addition to including recommendations which follow regarding water level monitoring, a high frequency of sampling should occur until an adequate water quality baseline is established. It is difficult to understand how in the interest of collecting as much information as possible in order to develop remedial plans, that many deeper wells appear not to have been sampled after their installation (deeper Wells F-6A, N-1, N-2, N-3, and N-4). Reports should illustrate all relevant data, including data for the "F" series wells and should present both water level and contaminant data spatially, and also temporally in water level and water quality hydrographs for perchlorate and chlorinated compounds of interest and also along, and across plume transects with distance.

11) All data collection activities undertaken in the Fontana-Colton-Rialto area by consultants for the County, or other parties, should be performed with a standard set of protocols. These protocols should include, but not be limited to the following: similar laboratory procedures, method detection limits, and reporting limits; a requirement for geophysical logging by appropriate methodologies, including neutron logging in the vadose zone for all subsurface borings; and a standard electronic report and data deliverable requirement so information can be shared by regulatory agencies, impacted parties, and other stakeholders. All regulatory agencies should coordinate their specific requirements so that one set of procedures can be put forth to assist in accurate and comparable data collection and analysis.

2. SEQUENTIAL COMMENTS

Executive Summary, Paragraph 2

"... the historical use of the Bunker Area or munitions / fireworks storage and disposal, coupled with detection of elevated perchlorate concentrations in groundwater samples collected beneath the ponds area, indicates that soils in the former Bunker Area likely continue to be a threat to water quality in the area." These sources are not included in a clear and detailed conceptual model to help in developing a meaningful remedial strategy.

Executive Summary, Paragraph 3

"Analytical results obtained for the study indicate that the distribution of perchlorate impacts to groundwater associated with the former Bunker Area is relatively restricted, and does not extend beyond about 4000 feet to the southeast of the now inactive wash ponds." The full extent of the contaminant plume has not been adequately delineated and further investigation should be carried out to characterize groundwater contamination to the east, southeast, and southwest of Well N-10. The conclusions reached from analysis presented on Figure 18 and data presented in Table 40 likely underestimate the plume distance associated with the release emanating from the MVSL. Although the graphs shown on Figure 18 do illustrate a downward trend in mass load as calculated by GLA with distance (which is expected for any evolving plume), there are three aspects of these analyses that invalidate the nature of the conclusion noted in the Report.

1) Any plume mass evaluation must consider the groundwater hydraulic gradient and direction. The particular type of analyses presented (attempting to show mass load decrease along the plume axis) is highly sensitive to the location of wells in relation to the centerline of the plume. If the wells used in the analyses are not directly aligned

downgradient from one another, a steeper negative slope on this plot would be expected relative to one calculated along the plume mass centerline. If in fact the plume centerline is located north of Well N-9, or if it bends, the trend illustrated by an accurate plot similar to Figure 18 could show a significantly greater distance to intercept with the zero milligram per square foot (mg/ft^2) axis, indicating a plume longer than 4,000 feet.

2) Associated with the sensitivity of the analysis shown on Figure 18 to the location of the plume centerline of mass, it is important to note that the gradient illustrated on Figure 14 of the Report relies on water level data collected at Well N-9 almost two months prior to other wells, and from a water level collected from Well N-10 noted during drilling. Even if the water level elevation for Wells N-9 and N-10 were collected at the same time as other wells, the water level data from Well N-9 are highly questionable as the well went dry and Well N-10 water level data may not represent true aquifer conditions. Because of uncertainties associated with the groundwater gradient, this calls into question overlying analyses both in regard to assertions regarding plume travel distance and groundwater modeling based on gradients presented in the Report.

3) Even if the underlying assumptions regarding the location of wells related to the plume centerline, calculation of mass loading, and the disregard of mass in Well N-10 were all valid, the analyses presented on Figure 18 are biased to result in a shorter plume distance and do not consider well-founded information on plume contaminant distributions. In particular, groundwater contamination plume mass does not tend to be distributed linearly, but is more logarithmic, or gaussian, with distance along the flow direction. This is related to fate and transport properties of contaminants in the subsurface, and generally, on plots of mass or concentration vs. distance in the downgradient direction, it would be expected that there is not a linear decrease in contaminant mass. When the data presented by GLA on Figure 18 are evaluated on a logarithmic scale (which is generally between a linear and gaussian distribution, thereby under-estimating what would be expected by gaussian fits), the distance to the zero mass load axis is more on the order of 10,000 to 15,000 feet.

Page 7, Paragraph 2

"Monitoring for perchlorate at MVSL was first conducted at all facility monitoring wells in October 1997." Only data for West Valley Water District Well #22 are presented in the Report from October 1997. All relevant historical data including soil and groundwater samples evaluated for perchlorate should be submitted in one volume to facilitate review of data.

Page 7, Paragraph 3 and Figure 4

The text discussing Well F-3 perchlorate detections does not correlate with Figure 4. Figure 4 indicates non-detectable or low concentration results for tetrachloroethylene (PCE) and trichloroethylene (TCE). Although these data are impossible to verify in the Report as they were not provided, if Well F-3 was dry, there should be no results after January 2002. Additionally, critical information such as water level data that are essential to the discussion should have been plotted.

Page 11, Paragraph 1

"Three aquifers are separated by low permeability, laterally continuous aquitards." This statement does not appear to be supported by the data generated by the Report, as soil borings advanced for Wells S-1R and S-2 reportedly did not identify the Regional Aquifer. Also, based on cross-section A-A', it appears that the properties of the finer grained lithologic sequence immediately above the Regional Aquitard may change in the downgradient flow direction. This is most evident in two ways: 1) in the thinning of what may be interpreted as the overlying aquitard for the Regional Aquifer as depicted on Plate 1, thinning from a thickness of approximately more than 15 feet at Wells N-9 and N-9 to approximately 10 feet at Well N-10; and, 2) in the decrease in head difference as monitored in vertically separated temporary wells towards the southeast. If the aquitard between the Intermediate Aquifer and the Regional Aquifer thins, or decreases in effectiveness between Wells N-9 and N-10, there may be a significant degree of downward contaminant migration to the Regional Aquifer near this vicinity.

Page 11, Paragraph 3

"As discussed below, the Intermediate Aquifer actually consists of a number of smaller water-bearing units that are separated by relatively thin (*e.g.* <5 feet thick) aquitards with a downward hydraulic gradient between the subunits." This statement should more accurately characterize the hydrogeologic composition of the Intermediate Aquifer by stating that the numerous silty sand lenses discussed as aquitards in the Report are discontinuous and likely cannot be categorized as "subunits."

Page 11, Paragraph 5

"... groundwater elevations at the site have dropped as much as 58 feet within the past 4 years." This hydrogeologic trend should be incorporated in the conceptual model to be developed for

the MVSL. The implications of this decrease in groundwater levels on fate, transport, and remediation of groundwater contaminants should be discussed.

Page 12, Paragraph 1

Important data such as porosity should not be estimated by literature review, but should be measured at several locations laterally and vertically within the aquifers of interest.

Page 14, Paragraph 1

This paragraph includes a reference to details presented in the Site Inspection Report (Bechtel Environmental Inc., 1992) that "wastes listed for the second facility included halogenated aromatics, latex, amides, amines, and plastics." A similar statement is made by GLA in their 1998 Offsite Migration Assessment Report; however, in that report it is stated that "the second facility identified by Bechtel reported disposal of an unknown quantity of organic liquids and solids between 1970 and 1971. The wastes listed for the second facility included halogenated aromatics, latex, amides, amines, plasticizers, resins, solvents, oils and oil sludges, ketones, alcohols and ignitable wastes." If GLA and/or the County can provide further information that proves that (possibly liquid) ignitable wastes were not disposed of at the MVSL, that would be beneficial in clarifying one potential historic source of perchlorate. If not, the possibility that both waste disposal events specifically may have caused a release of perchlorate needs to be incorporated into the conceptual model for the MVSL.

Page 16, Paragraph 7: Reference Figure 9

Related both to the discussion of perchlorate sources beneath MVSL Unit 5 and to the overall advancement of characterization activities, a figure combining information on bunker locations should be combined with the relevant current and recent past MVSL geometry and activities. In particular, locating soil borings DB-1 through DB-5 on a map illustrating their location in relation to underlying former bunker sites is essential. This figure as proposed could also assist in performing further characterization activities beneath MVSL Unit 5 to evaluate sources of perchlorate, PCE, TCE, other chlorinated solvents and NDMA indicated by the results of water samples from soil borings DB-1 through DB-5 and Wells N-5 and N-3.

Page 18, Paragraph 1

It is important to note as stated earlier that important information such as the detection of perchlorate between 1,400 and 3,960 mg/kg in wipe samples collected from Bunkers D3 and C2 in 1998 (IT Corporation, 1998: cited in the Report) was not discussed in Section 4. It is essential

that any and all data associated with potential sources of perchlorate and other contaminants related to the MVSL and the surrounding area be considered in evaluating sources of contamination to the drinking water aquifers. All of these potential sources, but most importantly those underneath MVSL Unit 5, should be incorporated in the conceptual model.

Page 19, Paragraph 1

It is important to note that perchlorate was detected in five of 57 soil samples collected from shallow soil borings. This is particularly important because of the nature of the materials being sampled. The soil boring logs noted rebar and debris likely associated with the former bunkers. With a sampling matrix potentially comprised of rubble, it is not surprising that very few samples detected any perchlorate, even if it is present, which heightens the significance of any detections in these shallow soil borings.

Page 20, Section 6.4

Results of the advancement of the five deeper soil borings DB-1 through DB-5 should have been incorporated into the full evaluation of perchlorate impacts with the results from the investigations associated with Wells N-1 through N-10. Based on data collected during advancement of DB-1 through DB-5, there are five major issues that were not discussed at any length in the Report:

1) The identification of a potential perching layer at approximately 360 feet bgs is very significant for remediation planning and in developing an accurate conceptual model for the Site. If a significant mass of chlorinated solvents, and/or perchlorate is present in perched groundwater, this may serve as a long-term source, either during recharge, or if this represents the historic Upper Aquifer;

2) The significance of the detection in groundwater of up to 340 and 140 ug/L of perchlorate and TCE, respectively, upgradient of Wells N-5, F-6A, and N-3, was barely mentioned in the Report. These detections at more than 85 and 28 times the regulatory levels for perchlorate and TCE, respectively, indicate that a significant source of contamination is located likely to the north and/or west of these locations.

3) Mutli-level groundwater monitoring wells or well clusters should be installed in the area investigated by DB-1 through DB-5 and upgradient as soon as possible. Additionally, vadose zone investigation activities centered specifically on all 20 of the former bunkers should be conducted to identify if any recoverable TCE, chlorinated

solvents and/or perchlorate can be remediated from the vadose zone prior to migration to groundwater.

4) The presence of the perched zone and sporadic notations of significant moisture indicate that neutron logging would assist in defining potential perched zones that should be the focus of contaminant investigations.

5) The logging of more than 50 continuous feet of clay in soil boring DB-1 at a minimum should have been discussed in the Report, as this significantly deviates from any depositional model that corresponds to other lithologies described in the Report. A major anomaly such as this needs to be incorporated in the conceptual model for the MVSL, as it may be very important with regard to contaminant migration in the vadose zone or otherwise.

Page 21, Paragraph 6

At locations with significant lithologic variations and/or groundwater contaminant distributions, multiple separate screened wells or appropriate multiple-level wells should have been installed. Multiple discrete screened intervals may not be necessary at all locations; however, a sufficient density is needed to understand both existing and future vertical gradients and the vertical distribution of contamination. The broad well screening goal based upon only the highest concentration of perchlorate has not resulted in a sufficient permanent monitoring well network that can fully describe the fate and transport, or monitor the effectiveness of remediation in the Intermediate or Regional Aquifers. In fact, as illustrated in Section 7.10.2 of the Report and discussed later, the installation of multiple screens in Well N-5 may have caused cross-contamination within the Intermediate Aquifer. The use of multiple screens in one well should be discontinued, unless properly designed, and the need to abandon and re-install wells N-5, N-6, and N-7 should be evaluated.

Page 22, Section 7.5

The use of undeveloped "temporary wells" to monitor water levels should have been verified by temporal gauging. As illustrated by the behavior of Well N-9, even permanent wells may not be accurate indicators of water levels, and as such, all water level information from "temporary wells" should be used carefully, if at all. At least four of the wells in the Intermediate Aquifer (preferably with only one screen) and three wells in the Regional Aquifer should be equipped with continuous reading water level measurement devices to evaluate gradient trends and to collect data regarding the significant groundwater level declines in the Intermediate Aquifer.

Page 25, Section 7.7.2

At least one observation well should have been installed to provide a monitoring point in the aquifer being tested other than the pumped well. Aquifer parameters estimated from observation wells are more accurate than those for pumped wells, and without an observation well, no estimate of storativity can be derived. As discussed earlier, the analyses at Well N-7 may be based upon a flawed aquifer test where the water level may have been drawn below the bottom of the top screen. If this is the case and the aquifer test needs to be repeated, an observation well should be installed and monitored during testing.

The aquifer test analysis description in the Report should clarify how the conditions of partial penetration of an aquifer and a two-screen well with two sandpacks were accounted for during analysis. In addition, the logic behind applying both confined and unconfined aquifer solutions to estimate aquifer parameters should be provided.

Page 27, Paragraph 1

Well S-1R and the piezometer at location S-2 should be replaced.

Page 27, Section 7.8.3

All soil borings deeper than 15 feet bgs should be logged geophysically, including neutron logging in the potential source area. Difficulties encountered in selecting screen depths and in interpreting data on cross-sections can be greatly reduced by using these methods. Additionally, the logic discussed related to the Well N-9 temporary well perchlorate detection is not valid, as the concentration for samples collected above the interval in question were lower concentrations.

Page 28, Section 7.9.1

Data for soil borings DB-1 through DB-5 should have been incorporated on cross-section A-A', and a separate cross-section for the source area should have been prepared. Additionally, it is unusual to designate the same Unified Soil Classification System (USCS) classification within a similar depositional environment as both an aquitard and an aquifer. To verify the validity of these types of interpretations, geophysical logging should be implemented as mentioned before, and soil geotechnical analyses such as porosity, permeability, and grain size distribution should be conducted as necessary. In addition, the designation of an aquitard should also consider vertical hydraulic head differentials. The data from the vertical temporary wells should be

clearly tabulated for all locations and used to verify the conceptual designation of aquitards in the vicinity of the MVSL.

Page 29, Section 7.9.3

As stated earlier, the use of water level data from temporary wells is suspect. In addition, the use of water level data from wells with multiple screened sections that may be separated by an aquitard is questionable. Given the severity of the contamination issues, all data that can be collected and used should be. All wells in the vicinity of the MVSL, including wells designated as "F" wells, should be gauged. As a result of issues noted above and earlier, the groundwater gradients in the Report are questionable and must be verified. To develop a satisfactory level of certainty regarding water levels and gradients, beyond the recommendation for continuous water level data collection, all wells related to the MVSL and others as appropriate should be gauged on a monthly basis at a minimum.

Page 29, Section 7.10.1

Meaningful tabulation and analysis of general chemistry data should have been provided. Plots such as Stiff, Piper, and others should be prepared to assist in understanding groundwater flowpaths and aquifer mixing and/or separation. Analyses of selected groundwater samples from the Intermediate and Regional aquifers for isotope analyses should be considered.

Page 30/31, Section 7.10.2

Some tables illustrating results of soil data have units of ug/L.

Figure 16 and the text of Section 7.10.2 should also discuss the findings of groundwater samples collected during advancement of borings DB-1 through DB-5.

Although it may be "interesting" that Well N-5 illustrated a decrease in perchlorate concentration in conjunction with a decline in water level elevation, this observation may more importantly indicate that the well was serving as a conduit for vertically cross-contaminating deeper portions of the Intermediate Aquifer. As water level data were not provided in a meaningful tabulation, it is impossible to further evaluate this serious observation. However, if as asserted in the Report, "This response is believed to reflect the presence of relatively highly impacted groundwater in the shallowest zone, with substantially less-impacted water below," and if there has been a downward gradient across the "aquitards interval," then the "relatively highly impacted groundwater" may have been migrating from the upper screen to the lower screen and decreasing the quality of the previously "less-impacted water below."

The trend of concentration with distance and depth for Wells N-5/F-6A to N-8/N-7 to Wells N-9 and N-10 clearly indicates a diving plume originating from groundwater somewhere in the vicinity of the MVSL Unit 5. The exact lateral centerline or vertical migration of the center of mass is not fully defined, but conceptually, as with contamination associated with MVSL Unit 1, perchlorate and other contamination is moving downward as it moves laterally through the Intermediate Aquifer. Although not discussed extensively in the Report, the detection of perchlorate in both Regional Aquifer Wells N-8 and N-10 may be an indicator that this Intermediate Aquifer contamination has reached the Regional Aquifer. As such, further investigation should be pursued in the Regional Aquifer to identify the extent of impacts potentially crossing into the Regional Aquifer, as illustrated in some modeling scenarios by GLA near Well N-8.

Although there may be a casual correlation between the detection of perchlorate and TCE, data for such a correlation should be presented and statistically verified to demonstrate if a significant correlation between the two exists.

The significance, if any exists, of a pattern of perchlorate correlations with TCE to correlation of PCE to TCE ratios must be further explained. It definitely is useful to evaluate all contaminant data available and that process should be continued. Clearly the detection of TCE in perched groundwater and Intermediate Aquifer groundwater from borings DB-1 through DB-5 indicates a different surficial source of contamination than any contamination emanating from the vicinity of MVSL Unit 1; however, beyond the potential co-presence of one or more surficial sources of TCE and perchlorate beneath the MVSL Unit 5, given the significantly different fate and transport behavior of these chemicals, it is premature to draw any conclusions based on correlations without a longer set of time series data. What may yield some information in regard to different geographic or temporal sources is a potential spatial pattern of chlorinated solvent detection. Most water samples with contamination detected PCE and/or TCE, however a select number of samples also detected 1,1,1-trichloroethane (1,1,1-TCA). There may be a significant pattern of detections of PCE/TCE and their daughter products (1,2-dichloroethylene isomers and 1,1-dichloroethylene [1,1-DCE]) and also 1,1,1-TCA and it's primary daughter product (1,1-dichloroethane [1,1-DCA]) that can be used to evaluate source locations and/or timing. Related to the detection of 1,1,1-TCA, 1,4-dioxane should be monitored carefully, as should NDMA, which was detected in the water sampling for Well N-3.

Page 34/35, Section 9.1

Although it is encouraging that significantly elevated concentrations of perchlorate were not detected in samples collected from bunker debris, the results in the Report do not rule out that

significant pockets of perchlorate and/or other contaminants exist. Given the complex nature of the matrix being sampled and the unknown disposition of specific bunkers and their debris, only vadose zone monitoring using techniques like suction lysimeters in the vicinity of the Visual Berms may be able to resolve whether a long-term source of perchlorate to the subsurface may be present.

It is more than likely given the observed levels of perchlorate in groundwater in the immediate vicinity of MVSL Unit 5 and the history in this area that significant masses of perchlorate and/or other contaminants reside at depths associated with the former ground surface or beneath areas of previously undisturbed bunkers. One aspect of the conceptual model to be developed should be that although there may have been external handling, use, testing, and disposal of materials containing perchlorate in the area, the bunkers themselves were relatively static features dating back to the 1940s. Although recent recharge activities above the footprints of several bunkers may have accelerated the migration of contaminants to groundwater, it is essential to also consider that areas containing perchlorate and other materials that were shielded from natural recharge beneath bunkers have only been exposed since the demolition of these bunkers. As such, contamination located in recently exposed areas that may not have been influenced by recharge from washing operations or other landfill activities may still remain at or near the former ground surface, or may be migrating through the vadose zone to groundwater. Therefore, the mass of contamination observed and the theorized fate of that contamination documented in the Report may represent an increased mass flux associated with the washing operations, while there may be significant contamination mobilized by the bunker destruction activities, not associated with washing operations, that is migrating through the vadose zone towards groundwater.

The conceptual model for the MVSL needs to consider the historical operations beneath the entire MVSL, the specific bunker histories and timing of activities beneath MVSL Unit 5, and the relatively extreme changes that occurred during the bunker demolitions, which may have resulted in an exposure of previously immobile contaminants. Based upon a sufficient conceptual model, further investigation to fill data gaps regarding sources of contamination in the vicinity of the 20 bunkers should be undertaken and appropriate remediation pursued to avoid the necessity of cleaning up contamination in groundwater after the contamination has migrated through the vadose zone.

Page 35, Section 9.2.2

Although some type of "mass load" concept may be helpful in evaluating the lateral extent of contamination within a particular aquifer, this approach can over-simplify evaluation of vertical

movement of contaminants in the downgradient lateral direction. Groundwater contaminant concentrations with elevation and lithology should have been illustrated in a cross-sectional figure. When the data are evaluated in this manner, a clear decline in elevation in the center of mass of contamination with distance from the MVSL is apparent.

As discussed previously, the concept that contamination can only have traveled a distance of approximately 4,000 feet based on the mass loading concept in the Report has a significantly large error range and underestimates the extent of contamination related to the MVSL. The reliance on an average groundwater velocity methodology to assert a migration length of 4,000 feet also has significant statistical error associated with it, and this number, taking the highest groundwater velocity of 5 feet per day, could also be used to estimate that the plume has moved on the order of 9,125 feet in five years. If any recent increased release of perchlorate is directly attributed to not only the washing operation, but also the destruction of the bunkers and subsequent mobilization of contamination that may have occurred prior to 1999, the plume travel distance as estimated in the Report could be greater than 10,000 feet.

Last, as documented in the modeling section which follows, there are significant errors in modeling assumptions and procedures, and therefore in any conclusions drawn from the modeling. In particular related to the concept of the extent of impacts associated with MVSL, the modeling itself as illustrated in Appendix F, Figure 19a, does not explain the contamination at Well N-10. Although there may be other sources of perchlorate in the vicinity of the MVSL, including one immediately to the south of the Robertsons Ready-mix area, the alternative hypotheses suggested in the Report do not appear valid based on modeling. Illustrations of contamination modeled distributions due to single and dual releases at the MVSL in Appendix F, Figures 14a, 14b, 16a and 16b, clearly indicate that contamination emanating from an area northwest of Well N-5 can reach Well N-10 and also result in contamination of the Regional Aquifer. Also, under no simulation illustrated in the Report is Well N-10 impacted by a source other than the MVSL.

Given that the process of modeling itself has significant errors, that the model simulation mass distributions themselves indicate that only MVSL can be the source of contamination for Well N-10, and that the model likely under-predicts impacts from the MVSL, the conclusion that modeling data support the inference that impacts only extend a distance of 4,000 feet is not valid.

Page 36, Section 9.2.2

The assertion that "perchlorate delivered from a 1999 release in the former Bunker Area is likely to be limited to the Upper and Intermediate aquifer identified in the area, and significant impacts to the Regional Aquifer are neither anticipated nor observed," is not supported by data or analysis presented in the Report. In fact, Wells N-8 and N-10 in the Regional Aquifer installed as part of the investigation are contaminated by perchlorate, and groundwater modeling scenarios in the Report as illustrated by Appendix F, Figures 15a/b and 17a/b, illustrate that contamination of the Regional Aquifer by contamination from the MVSL may have already occurred, but at a minimum is actually predicted by groundwater modeling in the Report.

Page 36, Section 10.0

As several underlying assumptions and analyses in the Report have been shown to be inaccurate, or to have significant ranges associated with them, it is likely that contamination from the MVSL extends more than the asserted 4,000 feet. Additionally, given the approximate half-century of potential perchlorate-related activities beneath and in the vicinity of the MVSL, there are very little data to support that impacts identified in municipal productions wells are not associated with a release from beneath MVSL. Impacts to municipal wells may be from a combination of sources, including beneath MVSL Unit 5; however, significant additional work must be performed before any reliable conclusions regarding impacts to water wells by contamination coming from beneath the MVSL are made.

Figure 4

The scale of the chart titled "F-3 Analytical Results" is incorrect.

Figure 13

This figure is meaningless, as the equipotential contours are based on groundwater elevation data collected during drilling. Water levels are displaced to such a degree during drilling that it may not be possible to collect any relevant data at that time. Not only should a suitable period of time elapse prior to the collection of water level data, but well development should also occur.

Figure 15

No asterix on location N-9 (as in Figure 14).

3. EVALUATION OF THE GROUNDWATER MODEL

Comments related to the groundwater model documented in the Report include both general comments and sequential comments related to the modeling. Comments are based both on review of the Report and the underlying modeling report from 1998.

SUMMARY OF GROUNDWATER MODELING COMMENTS

1) The groundwater modeling documented in the Report is highly speculative, is based on technically questionable data, uses several layers of unjustified or incorrect assumptions, and is not based on a verified conceptual model. As such, very little useful information can be relied upon from the outcome of modeling scenarios.

2) Relying upon steady-state modeling in a basin with such significant head fluctuations in water levels is not appropriate. Transient simulations in the Report are based on steady-state calibrated boundary conditions. Because transient simulations are based on invalid steady-state assumptions, transient model conclusions are also invalid.

3) It appears that no contaminant transport calibration or even validation was performed.

4) The source concentrations and plume concentrations appear to have been modeled on the order of mg/L. Although there are no units indicated on simulation results showing concentration, if the modelers believed that such a high source term was necessary, all of the simulated plumes from the MVSL extend much farther than indicated on the figures. If the concentrations indicated on simulation figures are in mg/L, the lowest value contoured is 1 mg/L, or 1,000 ug/L. As such, plumes from MVSL which may appear to stop based on simulation figures prior to Well N-10 would run much farther down gradient before concentrations reach non-detectable levels.

5) The methodology of varying boundary conditions during the steady-state calibration based solely on the desire for resolving head instability, instead of using a strong conceptual model, is inconsistent with standard modeling practices.

6) The selection of release timeframes and arbitrary assignment of source concentrations for the MVSL and for hypothetical "alternate sources north and east" of the project area appears to have been made only for the purpose of indicating that some source other than the MVSL has impacted drinking water wells. Although it is acknowledged that there is a significant data gap regarding soil and groundwater concentrations to the north and east of the MVSL, assigning a greater source concentration and a longer

timeline of impact for the north and east hypothetical source was not justified in the Report relative to the shorter timeline or concentration for the MVSL source.

7) It is stated that, "In addition, while the hypothetical model does not predict a direct impact to monitoring wells N-1, N-6, and N-10, if the release is simulated to occur slightly west of the center of the 160-acre parcel, impacts to these wells would be predicted." While this statement may prove valid upon further investigation, it could just as easily be argued based on the modeling that, if the release emanating from the MVSL is simulated to occur slightly east of the position indicated on Figure F13a, impacts to Wells N-1 and N-6 would be expected.

8) The illustration of percent concentration values on Figures 19a and 19b appears to have been performed incorrectly and therefore presents a biased representation of the contribution of the MVSL plume to the aquifers relative to the hypothetical source modeled to the north and east. In specific, as noted in Appendix F, the source concentrations for both plumes were 100 and 1,000 mg/L, respectively, for the MVSL and hypothetical north/east source. The color gradations illustrated on Figure 19a and 19b represent "perchlorate plume values (% of initial concentration)." It appears that for the hypothetical north/east plume illustrated, the plume % shading was performed relative to a concentration of 1,000 mg/L; however, this also appears to be true for the plume emanating from the MVSL. In fact, if one were to use a concentration of 100 mg/L as the relative initial concentration for the MVSL plume, then a significantly different plume gradation would be illustrated (as shown on Figure 17). Also, Figure 19b for the Regional Aquifer appears to have been color-shaded incorrectly, leading to the illustration artificially implying that simulated concentrations from the hypothetical north/east plume to the Regional Aquifer are worse than as they truly were simulated.

9) Any reliance on the appearance of TCE with perchlorate to bracket release times is questionable for two reasons: 1) there are significant differences in chemical properties of these compounds which result in most cases of retardation of TCE relative to perchlorate transport; and 2) there may have been numerous different potential sources of TCE, perchlorate, and other contaminants present in the area now occupied by MVSL Unit 5. If contamination of the vadose zone and groundwater is coming from multiple sources beneath the MVSL, some releases may be of TCE, other chlorinated solvents, perchlorate, a combination of several, or only one of the above, and these releases may have been over entirely different periods of time. Therefore, the statement that "it was concluded that significant levels of perchlorate were not likely to have existed in groundwater near the site between 1988 and 1999" is invalid.

10) The Report states, "The fact that no perchlorate impacts have been identified in Rialto Well #3 and the lack of TCE in MVSL monitoring well F-6 in 1992 argues strongly against the two-stage release hypothesis." This statement is based on very little data and is in fact contradicted by groundwater modeling results. Although the exact specifications of the construction of Rialto Well #3 are not provided in the Report, the modeling appears to simulate the well as only extracting groundwater from the Regional Aquifer. In the Regional Aquifer, the concentration of perchlorate is illustrated as approximately 1 (units not provided). As production wells draw water from a large zone of influence and dilution in the well occurs as a result, it is not surprising that no impact has been observed at Rialto Well #3. Therefore, the conclusion based upon this theory should be reconsidered.

SEQUENTIAL GROUNDWATER MODELING COMMENTS

Page 33, Paragraph 4

The assignment of a release period between 1975 and 1985 from beneath the MVSL Unit 5 is overly optimistic. Significant activities potentially involving perchlorate date back to the 1940s for the area underlying MVSL Unit 5. For this reason, the starting date of release appears to have been derived with the purpose of illustrating a limited mass contribution to the aquifer. A more appropriate methodology would be to evaluate the range of potential release scenarios envisioned by a strong conceptual model and illustrate all outcomes of the range of release scenarios in time, concentration, and location related to the MVSL.

Appendix F: Page F-10, Section 3.5

The Report earlier states that portions of the Regional Aquifer may be unsaturated. How was this modeled and what are the implications of this condition on modeling results?

Appendix F: Page F-11, Section 3.6

It is stated that storativity is one of the most critical parameters related to the modeling. Earlier it is stated that the storativity value used in the modeling is from the recent pump test, and a value of 9.9E-05 was estimated. It is important to explain how a storativity value was derived from an aquifer test without an observation well. If the 9.9E-5 value is invalid and the value is closer to 9.93E-04 as estimated in earlier testing, this raises significant questions about the validity of any transient and/or fate and transport modeling. If the site-specific value is closer to 9E-04 when it is stated in Appendix F, Table 2 that varying the storativity coefficient by an order of magnitude results in "convergence problems," and the aquifer was modeled with a

storativity of 1E-4, there are significant issues with the validity of modeling simulations. As with significant portions of the Report not based on modeling, such as mass flux estimates, it is difficult to perform a meaningful evaluation of results and analysis when significant underlying data are incorrect or assumptions regarding use of data result in invalidation of analyses. Transient calibration might have assisted in resolution of these convergence problems and is necessary to perform any defensible transient simulations.

Appendix F: Page F-12, Section 3.8.1

As stated previously, assignment of an order of magnitude greater source concentration to a hypothetical source to the north and east of the MVSL was arbitrary. In addition, the modeling of concentrations on the order of 100's of mg/L illustrates a fundamentally unsound starting conceptual model.

Appendix F: Page F-12, Section 3.8.2

Given that later modeling runs indicate contamination from the MVSL reaches the Regional Aquifer after 13 years, it is highly suspect that no figure illustrating concentrations of perchlorate in the Regional Aquifer were presented for the 1999 originating release scenarios.

Appendix F; Page F-13, Paragraph 2

The statement that TCE should have been detectable at MVSL Well F-6 is not supported by any model simulations. Given the differential transport properties of TCE and perchlorate, it would be helpful to observe the hypothetical simulated distributions of TCE relative to perchlorate. However, as source concentrations are unknown, modeling simulations should provide a bracket of plausible concentration ratios in the source term and should also vary the location of releases. This bracketing should be based on a comprehensive conceptual model.

Appendix F: Page F-13, Paragraph 4

Although it is often impossible to model with all historical data, the groundwater extraction data presented in the Report are insufficient to make any reliable predictions of groundwater flow directions through time dating back to the 1970s, let alone the 1950s. The fact that perchlorate may or may not have been detected at certain drinking water wells based upon modeling relies heavily on accurate simulations of groundwater extractions. It appears in the Report that significant over-simplifications of pumping over the time periods modeled were made.

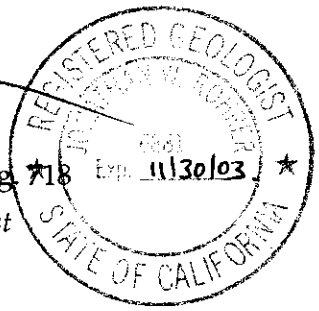
Appendix F: Figures F15a and F15b: The head difference between the high and low groundwater conditions may indicate significant consequences of incorrect steady-state and transient calibrations. The head range for Figure F15a, (Two Stage Release: 1990, high groundwater conditions) is from approximately 920 feet to 1,480 feet. The head range for Figure F15b (Two Stage Release: 1990, low groundwater conditions) is from 1,020 to 1,450 feet. In particular, it is difficult to explain how two scenarios, run with significantly different initial head distributions and what should be the same extraction rates, can result in the general head at the outflow end of the model being greater for a scenario that should represent a significantly lower head condition. This same observation holds for Figures F-16a/16b and F17a/17b. Issues such as this call into question all results of modeling.

CLOSING

We look forward to meeting with you and/or your staff to discuss these comments on November 18th and working with the RWQCB on behalf of the Fontana Water Company and West Valley Water District to review characterization and remediation activities and proposals in the interest of expediting the characterization, minimization of impacts, and the ultimate restoration of the impacted drinking water aquifers.

Sincerely,

KOMEX



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